Seabrook Station

North Atlantic

Updated Final Safety Analysis Report

Revision 7

CHAPTER 9

AUXILIARY SYSTEMS

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9.1 FUEL STORAGE AND HANDLING

The design characteristics of the Fuel Storage Building and its ventilation systems are discussed in Subsections 3.8.4, 6.5.1 and 9.4.2. The facilities are designed to meet the appropriate requirements of NRC Regulatory Guides 1.13 and 1.29. All fuel handling equipment (cranes and other devices) are designed with adequate margin to safely handle the dead loads plus assumed dynamic loads. (See Subsection 9.1.4.)

9.1.1 New Fuel Storage

9.1.1.1 Design Bases

The new fuel storage facilities are located within the Fuel Storage Building and are designed to facilitate the safe handling, inspection and storage of new fuel assemblies and control rods. Space is provided for handling and storage of 90 new fuel assemblies, which is equal to a $\frac{1}{3}$ core load plus 25 spare assemblies.

The new fuel is stored dry in storage racks. These racks are designed to withstand a safe shutdown earthquake (SSE), impact, handling loads and dead loads of the fuel assemblies, as well as meet ANSI N18.2 requirements. The object used to determine the impact load for the design of the racks is a fuel assembly (17x17), 8.426 inches square, 167 inches long, and a control rod weighing a total of 1615 pounds, and falling a distance of 6 feet above the top of the rack at a worst possible angle. All other objects are smaller, lighter and have less energy. The storage racks and anchorages are designed to withstand the maximum (rated) load which can be imposed by the auxiliary hook on the cask handling crane without an increase in K_{eff}.

The racks are designed and administratively controlled to provide a storage arrangement which assures a margin of subcriticality even in the unlikely event the new fuel storage vault is flooded with unborated water or is sprayed with fire fighting foam or mist. The design margins of subcriticality of $K_{eff} \leq 0.95$ under flooded conditions and of $K_{eff} \leq 0.98$ under conditions of low density, optimum moderation, are maintained by limiting the loading to 90 assemblies of fuel with enrichment up to 3.675 w/o ^{235}U and reducing the loading to 81 assemblies for enrichments from 3.675 to 5.0 w/o ^{235}U by limiting the fuel assembly placement in the central column of the new fuel storage vault to every other location.

The new fuel racks are designed for a postulated stuck fuel assembly load that causes an upward drag force of 3500 pounds (approximately two times the combined weight of a fuel assembly and control rod) to be exerted on the assembly upon attempted withdrawal. New fuel rack design also requires that the deformation of the impacted storage cells not adversely affect the minimum spacing requirements of 21 inches.

Provisions have been made in the crane handling system, by providing load limit switches, to insure that the maximum uplift force specified for the design of new fuel rack is not exceeded, thus averting any increase in K_{eff}.

Protection of the new fuel storage facilities from wind and tornado effects is discussed in Section 3.3. Flood protection is discussed in Section 3.4.

Missile protection is discussed in Section 3.5. Protection against fire hazards is discussed in Subsection 9.5.1.3. Radiation monitoring is provided to meet the requirements of 10 CFR 50, Appendix A, GDC 63. The radiation monitor is a GM tube-based area monitoring channel. The high range detector is an ion chamber. An alarm is initiated in the control room when the radiation level exceeds a predetermined setpoint (see Table 12.3-14). Details of the Radiation Monitoring System are provided in Subsection 12.3.4.

9.1.1.2 Facilities Description

The new fuel storage facilities are located adjacent to the spent fuel pool in the Fuel Storage Building to permit ease of handling of the new fuel into the transfer canal. The arrangement of the new fuel storage facilities is shown on Figures 1.2-15 through 1.2-21.

The storage vault is a rectangular concrete room containing the new fuel storage racks which securely hold the new fuel in a vertical position.

The storage racks are individual vertical cells that are fastened together to form a module. All surfaces of the racks that come into contact with fuel assemblies are made of austenitic stainless steel, whereas the supporting structure is painted carbon steel.

The racks are constructed so that it is impossible to insert fuel assemblies anywhere in the storage vault except where holes are provided. The holes have a minimum center-to-center spacing of 21 inches in both directions which is sufficient to maintain the design margins of subcriticality, $K_{eff} \leq 0.95$ under flooded conditions and $K_{eff} \leq 0.98$ under conditions of low density, optimum moderation. These criticality safety margins are maintained by limiting the loading to 90 assemblies of fuel with enrichment up to 3.675 w/o ^{235}U and reducing the loading to 81 assemblies for enrichments from 3.675 to 5.0 w/o ^{235}U by limiting the fuel assembly placement in the central column of the new fuel storage vault to every other location.

New fuel assemblies are delivered to the station in new fuel shipping containers. These containers are off-loaded from the transport vehicle in the Fuel Storage Building where the fuel assemblies are removed, inspected and stored in the new fuel storage vault.

K_{eff} of the vault vs. loading and enrichment is shown with uncertainties in Figure 9.1-18. From Figure 9.1-18, it can be seen that the fully loaded vault, 90 assemblies, has an enrichment limit of 3.675 w/o ^{235}U. Also, Figure 9.1-18 shows that either partial loading arrangements, 72 or 81, will allow fuel with enrichment up to 5.0 w/o ^{235}U under conditions of "optimum moderation."

The Fuel Storage Building is a seismic Category I building with an operating floor five feet above grade. There is a six-inch curb around the storage area to prevent any spillage onto the operating floor from flowing into the storage area. However, if water were to get into the storage area, the floor slopes down toward the new fuel upending area, and it would be removed by redundant 50 gpm sump pumps. Adequate spacing at the top of the fuel racks will preclude criticality resulting from placing a fuel element on the top of the rack. Grill work between rows of fuel racks provides a positive mechanical method of preventing insertion in positions not designated for fuel storage. Spaces between elements within the rack have physical barriers to prevent insertion of elements between fuel positions.

The new fuel storage facilities (storage vault and racks) are designed to maintain the fuel spacing during a safe shutdown earthquake (SSE). All critical components (walls, racks) are designed to meet seismic Category I requirements. (See Section 3.7 and Subsection 3.8.4.)

The cask handling crane and the spent fuel bridge and hoist are designed in compliance with Crane Manufacturer Association of America (CMAA) Specification 70, "Specification for Electric Overhead Traveling Cranes," 29 CFR 1910 and 29 CFR 1923 requirements. The cranes are not seismic Category I components; however, in compliance with Regulatory Position C2 of Regulatory Guide 1.29, the cranes' design parameters are specified to provide adequate quality control of fabrication and control of design so that in the event of a DBE or SSE, the cranes will not fail in such a manner as to reduce the functioning of any plant feature designated as seismic Category I by Regulatory Guide 1.29. The cranes are prevented from being dislodged off their rails during the SSE by mechanical anti-derailing devices. Figures 1.2-17 and 1.2-18 show the space envelope, boundaries and limits of hook travel of the cranes.

9.1.2 Spent Fuel Storage

The safety function of the spent fuel pool and storage racks is to maintain the spent fuel assemblies in a subcritical array during all credible storage conditions, and to provide a safe means for cask loading of the assemblies.

9.1.2.1 Design Bases

a. The spent fuel pool storage facility is designed in accordance with Regulatory Guide 1.13.

b. The spent fuel pool is divided into two regions with twelve free standing and self-supporting modules (see Figure 9.1-19). Region 1 has six modules with BORAL as the neutron absorber that allows space for 576 fuel assemblies. Region 2 has six modules with BORAFLEX that allows space for 660 fuel assemblies. The maximum pool capacity is 1236 assemblies.

c. Total fuel assembly storage capability is based on fuel storage cell geometry, center-to-center distance, lead-in angle requirements and poison thickness.

d. The Region 1 spent fuel racks are designed for high density fuel storage and contain BORAL as a neutron absorbing material to assure a $K_{eff} \leq 0.95$. The Region 2 spent fuel racks contain BORAFLEX as a neutron absorbing material to assure a $K_{eff} \leq 0.95$. Both Region 1 and 2 analyses assume the fuel is immersed in unborated water.

e. The mechanical design of the spent fuel pool storage racks is such that spent fuel assemblies cannot be inserted in other than designated locations. This mechanical design and the restrictions outlined in Figure 9.1-22 prevent any possibility of accidental criticality.

f. A minimum of 10'-0" of water above the highest fuel element position is provided to permit fuel handling without exceeding a radiation dose of 2.5 mr/hr at the surface of the pool. The concrete walls provide adequate radiation protection from irradiated fuel assemblies.

g. The impact load for the design of the racks is based on a 17x17 fuel assembly with attached spent fuel handling tool, weighing 2100 pounds, and falling a distance of 18 inches to the racks at the worst possible orientation. A 2100 pound load limit cutout in the hoist circuit (normal mode) prevents the crane from moving loads in excess of 2100 pounds over stored fuel.

h. The facility and the building in which it is housed is capable of withstanding the effects of extreme natural phenomena, such as the SSE, tornadoes, hurricanes, missiles and floods.

i. The spent fuel storage racks have been designed to withstand an SSE, impact, handling loads, and dead load of the fuel assemblies, as well as meet ANSI N18.2 requirements.

j. The design of the spent fuel racks incorporates the capability for a postulated stuck fuel assembly load that causes an upward drag force not experience any load other than compression during an SSE, liner plate will not fail, thus precluding conditions 1 through 3 from happening. Fuel racks are designed free standing such that no anchoring to the liner is required and the only load imposed on the liner is a compressive load.

Protection against the effects of tornado and wind loadings is discussed in Section 3.3. Protection against the dynamic effects associated with postulated pipe ruptures is discussed in Section 3.6. Radiation monitoring is discussed in Section 12.3.

9.1.3 Spent Fuel Pool Cooling and Cleanup System

9.1.3.1 Design Bases

The functions of the Spent Fuel Pool Cooling and Cleanup System are to:

a. Continuously remove decay heat generated by fuel elements stored in the pool,

b. Continuously maintain a minimum of 13 feet of water over the spent fuel elements to shield personnel, and

c. Maintain the chemical parameters and optical clarity of the spent fuel pool water, and the water in the reactor cavity and refueling canal during refueling operations.

All portions of the spent fuel pool cooling loop are designated Safety Class 3, and are designed and constructed to meet seismic Category I requirements. Those portions of the cleanup system not designed to these requirements are normally isolated from the cooling loop.

A leak detection system is provided (refer to Subsection 9.1.2.2).

All safety-related portions of the Spent Fuel Pool Cooling System are housed in structures capable of withstanding seismic and flood conditions, as well as tornado-generated missiles. Refer to Section 3.5 for a discussion of internally generated missiles and jet impingement. Protection against dynamic effects associated with postulated pipe ruptures is discussed in Section 3.6.

A seismic Category I normal makeup and a backup supply capable of being connected to an alternate seismic Category I source are provided.

The Spent Fuel Pool Cooling System is designed to assure adequate cooling to stored fuel, assuming a single failure of an active component coincident with a loss of offsite power.

The spent fuel pool cooling and cleanup system design temperature is 200°F, with a design pressure of 150 psig.

A full core offload is routinely performed as part of normal refueling operations. Refuelings are scheduled approximately every 18 to 23 months.

A fullcore offload during refueling outages is desirable to minimize fuel movement during replacement of the discharged fuel assemblies. The spent fuel pool temperature will remain below 141°F during the full core offload period provided that the time between shutdown and the completion of the offload is greater than 125 hours, considering normal cooling systems are in operation coincident with a single active failure. A full core offload may be completed prior to 125 hours after shutdown if the actual measured heat load including measurement uncertainty is less than 46.88 x 10^6 Btu/hr.

The Spent Fuel Pool (SFP) heat loads were calculated using the Branch Technical Position ASB 9-2 methodology including uncertainties as prescribed in Standard Review Plan Section 9.1.3. The uncertainty applied includes a 2% calorimetric uncertainty as well as calculational uncertainties consistent with the BTP ASB 9-2 decay heat methodology. The following assumptions were used in the calculation of decay heat.

1. The reactor core heat ouput is 3411 MWth.

2. The operating cycle length is 23 months. Full power operation is assumed for the entire period between refuelings.

3. The decay heat in the SFP is maximized by assuming an SFP storage capacity of 1490 assemblies consisting of the actual number of assemblies stored in the SFP at the end of cycle 5, plus eleven future refuelings with 88 assemblies per refueling remaining in the SFP, plus a final full core discharge at the end of license. The SFP is presently licensed for 1236 assemblies.

4. The full reactor core offload is a normal refueling condition at Seabrook and is considered in all decay heat calculations.

A steady-state calculation of the heat exchanger performance was used to determine the maximum spent fuel pool temperature for several normal and abnormal refueling conditions. The calculation of the normal cooling capability of the SFP Cooling System assumes the following:

1. Two SFP cooling heat exchangers in service. Primary component cooling water (PCCW) flow is 3000 gpm to each heat exchanger.

2. Two of the three SFP cooling pumps are in service. SFP cooling flow is 1100 gpm for each pump.

3. The Atlantic Ocean is in service or is capable of being placed in service to function as the ultimate heat sink.

A third SFP cooling pump, 1-SF-P10C, has been added to the original design to provide additional cooling capability for the heat load associated with a full core offload during refuelings. The third pump can be powered from either the A or B emergency buses. Electrical power is manually connected to 1-SF-P10C. Manual electrical connection assures adequate electrical separation of the emergency electrical buses.

The SFP Cooling System is designed to cool an SFP heat load of 46.88 x 10^6 Btu/hr and maintain an SFP temperature less than or equal to 141°F. This is referred to as the design basis heat load, and is equivalent to the heat load in the SFP assuming a full core offload is completed at 125 hours after shutdown plus the residual heat load from the spent assemblies stored in the full spent fuel pool, under normal cooling conditions.

The normal maximum heat load during power operation (e.g., after completion of the reload) has been calculated as 15.58 x 10^6 Btu/hr, which corresponds to the decay heat load from 88 freshly discharged assemblies at 30 days after shutdown in addition to the residual heat load from the spent assemblies stored in the full spent fuel pool. The SFP water temperature for the maximum normal heat load during power operation conditions is 118°F, under normal cooling conditions. If the outage duration is less than 30 days, adequate cooling capability exists to maintain the SFP temperature less than 140°F.

As described in the Standard Review Plan Section 9.1.3, for the abnormal maximum heat load and/or cooling system alignment, the temperature of the pool water should be kept below boiling and the liquid level maintained with normal systems in operation. A single active failure is not required in the evaluation of the abnormal case. Since Seabrook performs a full core offload as a normal condition during refueling, the limiting abnormal case is defined by the abnormal cooling configuration described below.

A passive failure of one SFP heat exchanger is the limiting abnormal cooling configuration. The thermal hydraulic evaluation of this case shows that for the design basis SFP decay heat load of 46.88 x 10^6 Btu/hr, the SFP water temperature will be less than or equal to 166°F. These conditions correspond to the decay heat load from a full core offload completed at 130 hours after shutdown, including the residual heat load from the spent fuel assemblies stored in the full spent fuel pool. The thermal hydraulic evaluation of this case demonstrates that there will be no boiling anywhere in the SFP under these conditions. This case assumed two SFP cooling pumps were in service through the operating SFP heat exchanger. Operational flexibility of the SFP Cooling System exists so that flow from two SFP cooling pumps may be aligned to one SFP heat exchanger to provide the necessary cooling.

A blockage of the Circulating Water tunnels requiring a switchover to the Cooling Tower as the ultimate heat sink was also evaluated as an abnormal cooling configuration. The evaluation of the steady-state performance of the heat exchanger for this case showed an SFP water temperature of 154°F for an SFP heat load equivalent to the design basis heat load of 46.88 x 10^6 Btu/hr. The thermal hydraulic evaluation of this case demonstrates that there will be no boiling anywhere in the SFP under these conditions. This case considered only one train of Service Water was in service with the PCCW system cross-connected. Two SFP heat exchangers are assumed to be in service with two of the three SFP cooling pumps in operation.

The abnormal case described in Standard Review Plan (SRP) 9.1.3 was also evaluated. The SRP describes the following case as an abnormal heat load condition. Since Seabrook performs a full core offload at each refueling, this case is considered as part of the normal SFP heat load evaluations, and is subject to the acceptance criteria of a maximum SFP temperature of 141°F. The heat load for this case consists of the decay heat from a full core offload at 150 hours after shutdown, plus one refueling load at equilibrium conditions after 36 days decay, plus one additional refueling batch at 400 days decay. The heat load was calculated using the Branch Technical Position ASB 9-2 methodology including the uncertainties specified in the SRP. The conditions of this scenario are bounded by the assumptions made for calculating the design basis heat load. Specifically, the design basis heat load assumes 16 cycles with an operating length of 23 months and full power operation over the entire period. In addition, the bounding decay heat load includes the residual decay heat from a full SFP with a maximum assumed capacity of 1490 assemblies. The SRP case considers the heat load from two refueling batches plus a full core. The operating time for the refueling batches are one year, and the full core operates for only 36 days in this scenario. The decay heat load calculated for the SRP scenario is less than the calculated design basis heat load. Therefore, the maximum SFP temperature for the SRP scenario will remain at less than 141°F calculated for the design basis heat load.

Table 9.1-3 summarizes the thermal design conditions for the Seabrook SFP.

Provisions have been made to remove decay heat from the stored spent fuel utilizing the alternate spent fuel pool cooling (ASFPC) heat exchanger. Reserved for periods when the reactor is defueled, and primary component cooling water (PCCW) would otherwise not be required, the ASFPC heat exchanger is supplied cooling water from the seismic Category I, Safety Class 3 Service Water System. A temporary nonnuclear safety cooling water source can also be used in conjunction with ASFPC.

Use of the ASFPC System is administratively controlled to limit the heat duty placed on the system while maintaining pool temperature at or below 140°F, based on ASFPC heat exchanger performance.

System component design data, together with the safety and code class requirements, are presented in Table 9.1-1.

Before each refueling outage, North Atlantic will evaluate the performance of the Spent Fuel Pool Cooling System to remove the decay heat load associated with the previously discharged fuel assembly and the full core offload. The evaluation will ensure that the SFP temperature will remain below 141°F during the full core offload.

9.1.3.2 System Description

The flow diagrams for this system are shown in Figures 9.1-1 and 9.1-2.

The Spent Fuel Pool Cooling and Cleanup System is comprised of three subsystems:

Spent fuel pool cooling subsystem

Spent fuel pool cleanup subsystem

Reactor cavity and canal cleanup subsystem.

The overall system is comprised of the following major components:

Three spent fuel pool cooling pumps

Two spent fuel pool cooling heat exchangers

One alternate spent fuel pool cooling heat exchanger

One inlet strainer

One pre-filter

One demineralizer

One post filter

One skimmer pump

Five spent fuel pool skimmer intakes

One reactor cavity cleanup pump.

a. Spent Fuel Pool Cooling Subsystem

The spent fuel cooling pumps take suction from the pool and circulate water through the heat exchangers which are cooled by the Primary Component Cooling Water System. An alternate spent fuel pool heat exchanger which is cooled by the Service Water System can be used when the reactor is defueled and PCCW would otherwise not be required. Pool water enters the suction line through a strainer near one wall of the pool at a point thirteen feet higher than the return line terminations. The return lines are located at a sufficient distance from the suction line to assure adequate circulation and uniform pool water temperatures.

All system connections to the fuel pool penetrate at elevations sufficiently above the top of the fuel to maintain adequate shielding in the event the water level drains to the penetration level. Piping arrangement precludes syphoning below this level. All components in contact with the spent fuel cooling water are stainless steel.

The spent fuel pool pump motors are Class 1E motors. SF-P-10A and SF-P-10B are powered from separate emergency busses. SF-P10C can be aligned to be powered from either emergency bus.

b. Spent Fuel Pool Cleanup Subsystem

Spent fuel pool water quality is maintained by a pool skimmer loop which filters and demineralizes the circulated water. The pool skimmer loop consists of five pool surface skimmers, a skimmer pump, two filters and a demineralizer. This system is utilized to maintain the pool surface free from floating particles and other materials and to remove radioactive materials in the water. The system is sized to process approximately 120 gpm, which means that one-half of the pool volume is processed in a day. All spent fuel pool cooling and cleanup system equipment is located in the Fuel Storage Building, except the filters and demineralizer which arelocated in the demineralizer area of the Primary Auxiliary Building.

The skimmer pump motor is not Class 1E, and is supplied from a local control center.

The spent fuel pool water quality requirements are referenced in the most recent revision to the EPRI PWR Primary Water Chemistry Guidelines. The EPRI reference is utilized to ensure current industry monitoring practices are maintained. Spent fuel pool purification performance will be monitored by isotopic decontamination factors and ionic impurity removal. Resin replacement will be typically based on these factors and on differential pressure.

Procedures for the station chemistry program are available. The sampling schedule is provided in the station chemistry program manual, which follows the EPRI PWR primary water chemistry guidelines.

Purification is achieved by a dedicated demineralizer containing mixed bed resin. Filtering is achieved with a post-ion exchange filter. A pre-ion exchanger filter is installed and is available as needed. Purification performance is monitored by observing water chemistry and by isotopic analysis across the demineralizer.

The EPRI Guidelines requirements on water chemistry are implemented in the Chemistry Manual and are compatible with the following materials used in the spent fuel racks:

Rack Assembly:	Cans: A-240 Type 304 Grids: A-240 Type 304 Foot Assembly: 17-4 PH SS, A564 Gr 630 - 304L SS, A193 SS
Liner:	Stainless Steel
Poisons:	BORAFLEX (Region 2) - a borated composition comprised of a polymeric silicone encapsulant entraining and fixing fine particles of boron carbide in a homogeneous, stable matrix. The boron carbide powder meets all the requirements of ASTM C-750-74 nuclear grade II material. BORAL (Region 1) - a composite plate material having exterior faces of aluminum alloy 1100 and a core composed of 1100 equivalent aluminum and boron carbide. The boron carbide material conforms to ASTM standard C750 Type 3. See AAR Advanced Structures General

Information Bulletin - 0.1 for additional information.

During operation of the alternate spent fuel pool cooling heat exchanger, administrative limits, given below, are placed on spent fuel pool water activity concentrations.

SFP Water Activity Concentration Limit For ASFPC
(μCi/ml)

D.E. I-131	4.2E-3
Cs-137	1.2E-2
Cs-134	2.3E-3
Te-132	3.4E-5
H-3	1.0E+0

c. Reactor Cavity and Canal Cleanup System

The reactor cavity cleanup portion of the system is designed to purify the reactor cavity during refueling operations to improve the optical clarity of the water. A composite drawing showing this function is shown in Figure 9.1-2, Sheet 3. The system consists of five surface skimmers at the water surface of the refueling cavity and canal and three drains, all piped to the suction of the reactorcavity cleanup skimmer pump via a lead-shielded disposable cartridge type filter unit. The lead-shielded filter removes radioactive particulate in the refueling water in order to prevent CRUD buildup in socket welded piping downstream of the skimmer pump. This filter also minimizes CRUD buildup in the CVCS and SF Cleanup System filters and demineralizers depending on the particular lineup. The cavity water is pumped through the chemical and volume control system mixed bed demineralizer and filters to the suction of the residual heat removal pumps where it is returned to a cold leg through a residual heat removal heat exchanger.

During cavity draindown upon completion of refueling, refueling water can be routed via the Reactor Cavity Cleanup System to the RWST via the Spent Fuel Cleanup System. Also, the Reactor Cavity Cleanup System may be used to send refueling water to the Liquid Waste System floor drain tanks. This lineup would be primarily utilized at the conclusion of draindown when the residual refueling water may not be suitable for return to the RWST.

As an alternative to utilizing the installed cavity cleanup pump and shielded filter, a provision exists to install temporary equipment between isolation valves SF-V81 and 85.

The reactor cavity cleanup pump motor is not Class 1E, and is supplied from a motor control center in the Control Building.

9.1.3.3 Safety Evaluation

Normally, more than 25 feet of water is maintained over the spent fuel. During fuel handling operations, the operator is protected from direct shine emanating from the spent fuel by at least 10 feet of water. The purification provided by the cleanup system, in addition to the water levels maintained above the spent fuel, result in a pool surface radiation level of less than 2.5 mr/hr, which allows unlimited operator access to the surface of the pool and cooling system components. However, the filters and the demineralizer in the cleanup system are expected to collect particulate and ionic radioactive materials, and thus have restrictive access. These components are located in the Primary Auxiliary Building behind shield walls.

To maintain pool water temperature below 141°F at the design basis heat load for maximum normal operating conditions (a full core offload 125 hours after shutdown with sixteen spent core regions in the pool), both SFP heat exchangers are required to be operable, with flow from two SFP cooling pumps. There are three SFP cooling pumps and each pump is capable of circulating water through either spent fuel pool heat exchanger. If one pump becomes inoperable for any reason, the remaining pumps can supply flow to each heat exchanger, maintaining pool water temperature below 141°F.

If only one spent fuel pool pump and heat exchanger are operable, the pool water temperature can be maintained below 140°F with 16 spent core regions in the pool. With 1100 gpm supplied from one spent fuel pool cooling pump, pool water will be maintained at or below 140° F when the alternate spent fuel pool heat exchanger is in service and one full core is stored in the pool. (Refer to Table 9.1-3.)

The Spent Fuel Pool Cooling and Cleanup System is designed so that the pool level will not be inadvertently drained below a point approximately 15 feet above the top of the spent fuel assemblies. The spent fuel pool suction line penetration and the return line terminations are located at elevations such that the failure of piping external of these penetrations will not result in lowering the pool water level below this elevation.

Each spent fuel pool heat exchanger is normally supplied cooling water from a separate primary component cooling water loop (see Subsection 9.2.2). During plant shutdowns when two trains of RHR are not required to be operable in accordance with the Technical Specifications the PCCW loops may be cross-connected so that one PCCW train supplies both SFP heat exchangers. In the unlikely event that all forced circulation cooling flow to the pool is lost, the large volume pool water (approximately 280,000 gallons) provides a heat sink which allows time for maintenance. PCCW cooling to the SFP heat exchangers is automatically isolated in response to a "T" signal. Manual operator action is required to restore PCCW flow to the SFP heat exchangers. The minimum time for the entire pool water volume to reach the saturation temperature from 140°F is 10.7 hours for the 16 spent core region storage condition. With 16 spent fuel regions plus one full core placed in the pool 125 hours after shutdown saturation temperature will be reached in 3.6 hours, assuming a starting SFP temperature of 140°F.

The alternate SFP heat exchanger is supplied cooling water from the Service Water System (see Subsection 9.2.1). Use of the alternate SFP cooling system will be evaluated on a case-by-case basis, as necessary.

Spent fuel pool makeup water can be obtained from either the refueling water storage tank, Chemical and Volume Control System, demineralized water, or the condensate storage tank, as necessary. The refueling water storage tank and its piping to the pool is seismic Category I. A hose connection is provided in the emergency feedwater pump suction piping from the seismic Category I condensate storage tank. The connection is located in the seismic Category I Emergency Feedwater Pump Building and serves as a backup source of makeup to the pool.

The failure of portions of the system, or of other systems not designed to seismic Category I requirements and located close to essential portions of the cooling loop, will not preclude essential functions.

Interconnections between the Spent Fuel Cooling System and the Chemical and Volume Control System are provided to supply borated water, if necessary. A failure analysis of the Spent Pool Cooling and Cleanup System is presented in Table 9.1-2.

9.1.3.4 Inspection and Testing Requirements

Operation of the system to meet construction and pre-operational cleaning needs satisfies the testing requirements. The active components of the system are in continuous use during normal plant operation. Periodic tests are performed for the spent fuel pool cooling pumps in accordance with station procedures. Routine visual inspection of the system components, instrumentation and trouble alarms provide adequate means to verify system operability. However, when the cooling and cleanup loops are cross-connected through valves SF-V14 and SF-V66 an operator is to be posted at the valves during the complete time the cross-connection exists, to assure that the valves can be closed immediately should circumstances require. Pool level indicators and associated alarms are tested by simulating low water level in the sensors. Preventive maintenance is conducted according to established station procedures.

9.1.3.5 Instrumentation Requirements

The instrumentation requirements for monitoring the Spent Fuel Cooling and Purification System performance are as follows:

a. The level in the spent fuel pool is monitored and level indication is available in the control room. Both high and low levels are annunciated in the control room, while low level is alarmed locally.

b. The pump discharge pressure is monitored for the cooling pumps and the fuel pool skimmer pump. Differential pressures are measured across the filter and demineralizer. Local pressure indications are provided. High differential pressures are annunciated in the control room.

c. Total coolant flow is monitored by a flow meter in the common discharge line from the heat exchangers. Local and control room indication is provided. Low discharge flow is annunciated in the control room.

d. The pool water temperature is monitored at the suction to the cooling pumps and both local readout and control room alarm and indication are available.

e. Motor controls for this system are located in a control panel adjacent to the equipment in the Fuel Storage Building, the associated motor control centers, or at the main control board.

9.1.4 Fuel Handling System

The Fuel Handling System (FHS) consists of equipment and structures used for the refueling operation in a safe manner meeting General Design Criteria 61 and 62 of 10 CFR 50, Appendix A.

9.1.4.1 Design Bases

a. The primary design requirement of the equipment is reliability. A conservative design approach is used for all load-bearing parts. Where possible, components are used that have a proven record of reliable service. Throughout the design of equipment in containment, consideration is given to the fact that the equipment will spend long idle periods stored in an atmosphere of 120°F and high humidity.

b. Fuel handling devices have provisions to avoid dropping or jamming of fuel assemblies during transfer operation.

c. Handling equipment used to raise and lower spent fuel has a limited maximum lift height so that the minimum required depth of water shielding is maintained.

d. The Fuel Transfer System (FTS), where it penetrates the containment, has provisions to preserve the integrity of the containment pressure boundary.

e. Criticality during fuel handling operations is prevented by geometrically safe configuration of the fuel handling equipment.

f. Handling equipment will not fail in such a manner as to damage seismic Category I equipment or spent fuel in the event of a Safe Shutdown Earthquake.

g. Except as specified otherwise in this document, the crane structures are designed and fabricated in accordance with CMAA Specification No. 70 for Class A-1 service.

h. The static design load for the refueling machine crane structure and all its lifting components is normal, dead and live loads, plus three times the fuel assembly weight with a Rod Cluster Control Assembly.

i. The original design allowable stresses for the refueling machine structures and components supporting a fuel assembly are as specified in the ASME Code, Section III, Subarticle XVII-2200.

Allowable stress criteria for rated loads for the spent fuel pool bridge and hoist, cask handling crane, and polar gantry crane are in accordance with CMAA-70. Modifications to the refueling machine components/structures meet the allowable stress limits per the AISC Manual of Steel Construction, 9th edition (Allowable Stress Design).

j. The design load on wire rope hoisting cables does not exceed 0.20 times the average breaking strength. Two cables are used in the refueling machine and each is assumed to carry one half the load.

k. A single finger on the fuel gripper can support the weight of a fuel assembly and Rod Cluster Control Assembly without exceeding the requirements of Item i. above.

l. All components critical to the operation of the equipment are located so that parts which can fall into the reactor are assembled with the fasteners positively restrained from loosening under vibration.

m. The inertial loads imparted to the fuel assemblies or core components during handling operations are less than the loads which could cause damage.

n. Physical safety features are provided for personnel operating handling equipment.

Industrial codes and standards used in the design of the fuel handling equipment:

a. Applicable sections of CMAA Specifications No. 70.

b. New Fuel Elevator Hoist: Applicable Sections of HMI-100 and ANSI B30.16.

c. Structural: ASME Code, Section III, Appendix XVII, Subarticle XVII-2200 (Refueling Machine).

d. Electrical: Applicable standards and requirements of the National Electrical Code and NFPA No. 70 are used in the design, installation, and manufacturing of all electrical equipment.

e. Materials: Main load-bearing materials conform to the specifications of the ASTM standard.

f. Safety: OSHA Standards 29 CFR 1910, and 20 CFR 1926 including load testing requirements; the requirements of ANSI N18.2, Regulatory Guide 1.29 and General Design Criteria 61 and 62.

Protection of the FHS from wind and tornado effects is discussed in Section 3.3. Flood protection is discussed in Section 3.4. Missile protection is discussed in Section 3.5.

9.1.4.2 System Description

The Fuel Handling System (FHS) consists of the equipment needed for the refueling operation on the reactor core. Basically this equipment is comprised of fuel assembly, core component and reactor component hoisting equipment, handling equipment and a Fuel Transfer System (FTS). The structures associated with the fuel handling equipment are the refueling cavity, the refueling canal in Containment and in the FSB, and the fuel storage area.

The elevation and arrangements drawings of the fuel handling facilities are shown on Figures 1.2-15 through 1.2-21.

a. Fuel Handling Description

New fuel assemblies received for core refueling are removed one at a time from the shipping container, lowered into the fuel storage area by the 5-ton hook on the cask handling crane, and stored in the new fuel storage racks.

The fuel handling equipment is designed to handle the spent fuel assemblies underwater from the time they leave the reactor vessel until placed in a container for shipment from the site. Underwater transfer of spent fuel assemblies provides an effective, economic and transparent radiation shield, as well as a reliable cooling medium for removal of decay heat.

The associated fuel handling structures may be generally divided into two areas: 1. the refueling cavity in Containment, and its canal, 2. the spent fuel storage area in the FSB, including the refueling canal and cask handling areas. The canal and cask handling areas are normally full of water and accessible to operating personnel and the fuel transfer sytem. The refueling cavity and the spent fuel storage area are connected by a fuel transfer tube. This tube is fitted with a quick closure hatch on the cavity end and a valve on the fuel storage area end. The quick closure hatch is in place and the valve kept closed except during refueling to ensure containment integrity. Fuel is carried through the tube on an underwater transfer car. Fuel is moved from the reactor vessel to the Containment refueling canal and into the FSB refueling canal by the refueling machine. A rod cluster control changing fixture is located in the Containment refueling canal for transferring control elements from one fuel assembly to another fuel assembly. The FTS is used to move fuel assemblies between the Containment Building and the Fuel Storage Building.

After a fuel assembly is placed in the fuel container, the lifting arm pivots the fuel container to the horizontal position for passage through the fuel transfer tube. After the transfer car transports the fuel assembly through the transfer tube, the lifting arm at the end of the tube pivots the container to a vertical position so that the assembly can be lifted out of the fuel container.

In the Fuel Storage Building, spent fuel assemblies are moved about by the spent fuel pool bridge and hoist. When lifting spent fuel loading plan for the respective fuel cycle.

With either method of conducting the refueling sequence, the fuel handling equipment is used in the same manner. Fuel assemblies are withdrawn or inserted into the reactor vessel using the refueling machine. Transfer of assemblies between the Containment Building and Fuel Storage Building is conducted using the Fuel Transfer System. Handling of fuel assemblies in the spent fuel pool is accomplished using the spent fuel pool bridge crane and spent fuel assembly handling tool. Transfer of core components from one fuel assembly to another is accomplished using any one of the various tools available either in the Containment Building or in the Fuel Storage Building. A description of the fuel handling equipment is presented in Subsection 9.1.4.2.c.

High pressure sodium vapor lamps (containing a mercury-sodium amalgam) which have a double, water impermeable barrier, may be used in containment and the FSB during refueling outages, or if SFP fuel movement/inspection is needed during the fuel cycle. These high intensity lamps provide improved lighting with negligible possibility of contaminants reaching reactor water or components, when used in a temporary capacity as described here.

4. Phase IV - Reactor Assembly

Reactor assembly, following refueling, is essentially achieved by reversing the operations given in Phase II - Reactor Disassembly.

During a reassembly of the reactor the vessel head and the water are lowered simultaneously until the vessel head engages the guide studs. At this point of the reassembly the water is lowered to the top of the reactor vessel flange. This allows visual observation of the insertion of drive rods into their proper locations in the vessel head.

c. Component Description

1. Refueling Machine

The refueling machine (Figure 9.1-3) is a rectilinear bridge and trolley system with a vertical mast extending down into the refueling water. The bridge spans the refueling cavity and runs on rails set into the edge of the refueling cavity. The bridge and trolley motions are used to position the vertical mast over a fuel assembly in the core. A long tube with a pneumatic gripper on the end is lowered down out of the mast to grip the fuel assembly. The gripper tube is long enough so that the upper end is still contained in the mast when the gripper end contacts the fuel. A winch mounted on the trolley raises the gripper tube and fuel assembly up into the mast tube. The fuel is transported while inside the mast tube to its new position. All controls for the refueling machine are mounted on a console in the trolley. The mast is equipped with hardware for in mast sipping tests of fuel assemblies.

The bridge and trolley are positioned on a coordinate system programmed internal to the RFM controls. The coordinate system is based on feedback by absolute encoders. The drives for the bridge, trolley, and hoist are variable speed from 0 fpm to maximum speed allowed for each axis. The maximum speed for the bridge is 60 fpm. The maximum speed for trolley is approximately 40 feet per minute, but may be slightly increased to allow smoother operation in a Semi-automatic or Automatic mode. The maximum speed for the hoist is 40 fpm. The auxiliary monorail hoist on the refueling machine has a two-step magnetic controller to give hoisting speeds of approximately 7 to 22 fpm.

Electronic interlocks and limit switches on the refueling machine prevent damage to the fuel assemblies. The winch is also provided with limit switches and an encoder to prevent a fuel assembly from being raised above a safe shielding depth. In an emergency, the bridge, the trolley and the winch can be operated manually using a hand-wheel on the motor shaft. The refueling machine is designed to permit the handling of thimble plugs using a tool supported from the auxiliary hoist.

2. Spent Fuel Pool Bridge and Hoist

The spent fuel pool bridge and hoist (Figures 1.2-16, 1.2-18 and 1.2-21) is a wheel-mounted walkway, spanning the fuel storage area, which carries an electric monorail hoist on an overhead structure. The spent fuel pool bridge and hoist is used primarily to handle fuel assemblies and associated core components within the fuel storage area by means of long handled tools suspended from the hoist. The hoist travel and tool length are designed to limit the maximum lift of a fuel assembly or core component to a safe shielding depth. The spent fuel pool bridge and hoist is also used to handle irradiated debris containers and to support fuel-related maintenance and inspection activities within the fuel storage area.

All material handled with the spent fuel pool bridge and hoist within the spent fuel pool is administratively controlled to ensure that the consequences of an accidental drop will not exceed the bounds of the most limiting case accident as described in Chapter 15. In addition to the administrative controls a 2100 pound load limit cutout in the hoist circuit (normal mode) prevents the crane from moving loads in excess of

2100 pounds over stored fuel. The spent fuel pool bridge has a two-step magnetic controller. The bridge speed is 11 and 33 fpm. Both the trolley and hoist have two-step adjustable frequency motor control. Trolley travel speed is adjustable from 3 fpm to 35 fpm and the hoist lifting speed is adjustable from 3 fpm to 24 fpm. A hydraulic coupling is used in the bridge drive to limit starting acceleration.

A push-button pendant is provided for controlling bridge, trolley, and hoist motions. All push-buttons are of the momentary contact type. Release of the push-button automatically stops motion and sets the brakes. Electrical interlocks are provided to prevent damage to the fuel assemblies (see Subsection 9.1.4.3).

3. <u>Cask Handling Crane</u>

The cask handling crane (Figures 1.2-17, 1.2-18 and 1.2-20) is an electric overhead traveling crane with a main hook rated capacity of 125 tons and two 5-ton auxiliary hoists. The bridge spans the new fuel storage area and the cask handling and decontamination areas. The crane serves the following functions:

- Upending new fuel containers and transferring new fuel to dry storage
- Transferring new fuel from dry storage to the new fuel elevator (auxiliary hook)
- Transferring spent fuel shipping casks in and out of the cask loading and decontamination areas.

The various speeds for the crane are as follows:

<u>Bridge</u>	5 to 50 fpm
<u>Main Hook</u>	
Trolley	4 to 40 fpm
Hoist	0.4 to 4 fpm
<u>Auxiliary Hook</u> (Monorail)	
Trolley	50 fpm
Hoist	Two speed: 7 and 21 fpm

The drives for the bridge, trolleys, and hoists are variable speed. Controls for all motions are full magnetic, 5-step, timed acceleration type. All motions can be controlled from either the operator's cab or push-button pendant controls.

4. <u>Polar Gantry Crane</u>

The polar gantry crane (Figures 1.2-5, 1.2-6) is an overhead gantry crane located in containment with a 103-foot diameter span to the rail centerline. The main hoist has an original design rated capacity of 420 tons and the auxiliary hoist is rated at 53 tons. In response to a notification from the crane supplier and subsequent evaluation, the main hoist has been derated to 302 tons (CMAA#70) and 193 tons (NUREG 0612). The various speeds (fpm) for the crane are as follows:

	Minimum (Full Load)	Maximum (No Load)
Main Hoist	0.2	3.5 (inching)
Auxiliary Hoist	1.9	30 (inching)
Bridge	40	50
Trolley	25	30

The polar crane is used during construction for installation of the reactor vessel and steam generators. It is also used to lift the reactor lower internals as necessary during the life of the plant. The crane is used to remove and replace the reactor head and upper internals during refueling operations.

Magnetic controls provide variable speed for each crane motion. The crane is arranged for cab and floor operation.

5. New Fuel Elevator

The new fuel elevator (Figures 9.1-4 and 9.1-5) consists of a box-shaped elevator assembly with its top end open, and is sized to house one fuel assembly.

The new fuel elevator is normally used to lower a new fuel assembly to the bottom of the FSB refueling canal where it is then transported to the spent fuel storage racks by the spent fuel bridge and hoist. Additionally, the new fuel elevator may be raised or lowered to support inspection and/or repair of new and irradiated fuel assemblies. Controls shall be in place to maintain the safe shielding distance when irradiated fuel is in the elevator. Non-fuel items and equipment may also be transferred using the new fuel elevator. The new fuel elevator hoist rated capacity is 3000 lbs. with a lifting speed of 21 fpm. The hoist is provided with integral motor brake and load brake and gear type limit switch with upper and lower limits. All portions of the elevator car which are immersed in water are stainless steel.

6. Fuel Transfer System

The Fuel Transfer System (Figure 9.1-6, Sheets 1, 2 and 3) includes an underwater, electric-motor-driven, transfer car that runs on tracks extending from the Containment refueling canal through the transfer tube and into the FSB refueling canal. A hydraulically actuated lifting arm is on each end of the transfer tube. The fuel container in the refueling canal receives a fuel assembly in the vertical position from the refueling machine. The fuel assembly is then lowered to a horizontal position for passage through the transfer tube. After passing through the tube, the fuel assembly is raised to a vertical position for removal by a tool suspended from the spent fuel pool bridge and hoist in the FSB refueling canal. The spent fuel pool bridge and hoist then moves to a storage loading position and places the spent fuel assembly in the spent fuel storage racks.

During reactor operation, the transfer car is stored in the FSB refueling canal. The quick closure hatch is engaged closed on the containment refueling canal end of the transfer tube to seal the reactor containment. The terminus of the tube in the FSB is closed by a valve.

7. Rod Cluster Control Changing Fixture

The rod cluster control changing fixture is a tool for changing rod cluster control elements in the reactor (Figure 9.1-7). The major subassemblies which comprise the changing fixture are the frame and track structure, the carriage, the guide tube, the gripper, and the drive mechanism. The carriage is a moveable container supported by the frame and track structure. The tracks provide a guide for the four flanged carriage wheels and allow horizontal movement of the carriage during changing operation. The positioning stops on both the carriage and frame locate each of the three carriage compartments directly below the guide tube. Two of these compartments are designed to hold individual fuel assemblies; the third is made to support a single rod cluster control element. Situated above the carriage and mounted on the refueling canal wall is the guide tube. The guide tube provides for the guidance and proper orientation of the gripper and rod cluster control element as they are being raised and lowered. The gripper is a pneumatically actuated mechanism which engages the rod cluster control element. It has two flexure fingers which can be inserted into the top of the rod cluster control element when air pressure is applied to the gripper piston. Normally the fingers are locked in a radially extended position. Mounted on the operating deck is the drive mechanism assembly which is comprised of the manual carriage drive mechanism, the revolving stop operating handle, the pneumatic selector valve for actuating the gripper piston, and the electric hoist for elevation control of the gripper.

8. Spent Fuel Assembly Handling Tool

The spent fuel assembly handling tool (Figure 9.1-8) is used to handle new and spent fuel assemblies in the fuel storage area. It is a manually actuated tool, suspended from the spent fuel pool bridge and hoist, which uses four cam-actuated latching fingers to grip the underside of the fuel assembly top nozzle.

The operating handle to actuate the fingers is located at the top of the tool. When the fingers are latched, a pin is inserted into the operating handle which prevents the fingers from being accidentally unlatched during fuel handling operations.

9. New Fuel Assembly Handling Tool

The new fuel assembly handling tool (Figure 9.1-9) is used to lift and transfer fuel assemblies from the new fuel shipping containers to dry storage or to the new fuel elevator. It is a manually actuated tool, suspended from the cask handling crane which uses four cam-actuated latching fingers to grip the underside of the fuel assembly top nozzle. The operating handles to actuate the fingers are located on the side of the tool. When the fingers are latched, the safety screw is turned in to prevent the accidental unlatching of the fingers.

10. Reactor Vessel Head Lift Rig (Modified to Suit Simplified Head Assembly)

The modified reactor vessel head lift rig (Figure 9.1-12) consists of a welded and bolted structural steel frame with suitable rigging to enable the crane operator to lift the head and store it during refueling operations. Extension legs have been added to accommodate the new components on top of the seismic platform that are part of the integrated Simplified Head Assembly (SHA). The SHA incorporates the missile shield, shroud panels, fans, DRPI, CRDM and other cabling. The lift rig is permanently attached to the reactor vessel head. Attached to the head lift rig are the monorail and hoists for the reactor vessel stud tensioners.

11. Reactor Internals Lifting Device

The reactor internals lifting device (Figure 9.1-10) is a structural frame suspended from the overhead crane. The frame is lowered onto the guide tube support plate of the internals, and is mechanically connected to the support plate by three breech lock-type connectors. Bushings on the frame engage guide studs in the vessel flange to provide guidance during removal and replacement of the internals package.

12. Reactor Vessel Stud Tensioner and Handling System

The Reactor Vessel Stud Handling System is provided with the capability of handling the studs independent of the main polar crane. The studs and stud tensioners are handled by the hoists supported from a monorail on the shroud structure. The stud tensioners (Figure 9.1-11) are employed to secure the head closure joint at every refueling. The stud tensioner is a hydraulically operated device that uses oil as the working independent wire ropes are anchored to the winch drum and carried to a load equalizing mechanism on the top of the gripper tube.

The working load of fuel assembly with an RCC inserted plus gripper is approximately 2600 pounds (1,000 lbs. for mast plus 1,600 lbs. for fuel assembly with RCCA). Minimum hoist design load is 133 percent of working load.

The gripper itself has four fingers gripping the fuel, any two of which will support the fuel assembly weight.

Prior to removing fuel, during each refueling outage, the Gripper and Hoist System are routinely load tested in accordance with Technical Specifications. The test load is greater than 125 percent of the setting on the hoist backup overload limit [3563 lbs = 125% (2600 + 250 lbs)].

2. Fuel Transfer System

The following safety features are provided in the Fuel Transfer System.

(a) Transfer Car Permissive Switch

The transfer car controls are located in both the fuel storage building and in containment. The system can be controlled from either console. The two consoles are networked together, and the console in the Fuel Storage Building will control the winch to move the carriage. On the console in containment, there is a local/remote switch which will give control to the refueling machine for automatic control of the car if all interlock conditions are correct.

Transfer of the car is possible only when both lifting arms are in the down position as indicated by the proximity switches. The switches and the controls in the consoles interlock out movement unless the frames are in the down position. If a switch failure occurs, a second set of contacts in the switch can be used by turning a switch on the control console for the switch. A bypass is also allowed for one operation (if necessary) at a time if both contacts fail. This bypass will reset itself automatically.

(b) Lifting Arm - Transfer Car Position

Two redundant interlocks allow lifting arm operation only when the transfer car is at the respective end of its travel, and therefore can withstand a single failure.

Of the two redundant interlocks which allow lifting arm operation only when the transfer car is at the end of its travel, one interlock is a proximity limit switch in the control circuit. The backup interlock is a mechanical latch device on the lifting arm that is opened by the car moving into position.

(c) Transfer Car - Valve Open

An interlock on the transfer tube valve permits transfer car operation only when the transfer tube valve position switch indicates the valve is fully open. A bypass is available for this interlock.

(d) Transfer Car - Lifting Arm

The transfer car lifting arm is primarily designed to protect the equipment from overload and possible damage if an attempt is made to move the car when the fuel container is in the vertical position. The interlock is redundant and can withstand a single failure. The basic interlock is a proximity limit switch in the control circuit. The backup interlock is a mechanical latch device that is opened by the weight of the fuel container when in the horizontal position.

(e) Lifting Arm - Refueling Machine

The refueling canal lifting arm is interlocked with the refueling machine. Whenever the transfer car is located in the refueling canal, the lifting arm cannot be operated unless the refueling machine gripper is inside the mast or the refueling machine is not over the lifting arm area.

(f) Lifting Arm - Spent Fuel Pool Bridge and Hoist

The lifting arm is interlocked with the spent fuel pool bridge and hoist. The lifting arm cannot be operated unless the spent fuel pool bridge and hoist is not over the lifting arm area.

Isolation gates are provided between the reactor cavity - containment refueling canal and the fuel storage-fuel handling areas in the FSB. In the event that maintenance or repairs are required on the Fuel Transfer System during refueling, the canal can be drained by closing the gates and isolating the reactor cavity and the SFP. This permits continued cooling of the core and the SFP, while repairs are effected on the Fuel Transfer System.

3. Spent Fuel Pool Bridge and Hoist

The spent fuel pool bridge and hoist includes the following safety features:

(a) The spent fuel pool bridge and hoist controls are interlocked to prevent simultaneous operation of bridge drive, trolley drive, and hoist.

(b) Bridge drive operation is prevented except when the hoist is in the full up position. The interlock allows jogging of the bridge in ¼" increments when the hoist is not in its highest position.

(c) Low voltage or no voltage for any motion automatically stops the motion and sets the brakes.

(d) A trolley-bridge interlock prevents travel of the bridge from the spent fuel storage area or cask loading area into the interconnecting canal unless the hoist is centered on the canal.

(e1) A 2100 pound load limit cutout in the hoist circuit (normal mode) prevents the crane from moving loads in excess of 2100 pounds over stored fuel.

(e2) A second overload protection device is included (bypass mode) on the hoist to limit the uplift force which could be applied to the fuel storage racks. The protection device limits the hoist load when lifting an assembly clear from its seated position to 125 percent (2500 lbs.) of the total weight of a fuel assembly plus control rod and handling tool.

(f) Restraining bars are provided on each truck to prevent the bridge from overturning.

(g) Upper limit switch actuation prevents withdrawing a fuel assembly beyond the hoist upper limit.

(h) To assure that the design of the spent fuel bridge and hoist is adequate to withstand the safe shutdown earthquake without loss of structural integrity, the following measures have been implemented:

(1) A seismic analysis has been performed (by the vendor) in accordance with the design control procedures for seismic Category I components for this crane to demonstrate that it will not lose its structural integrity during or subsequent to an OBE or SSE.

(2) Quality control requirements for material processing, welding, and nondestructive examination have been incorporated into the relevant specifications and purchase order documents for this crane to provide a level of confidence in the

material and fabrication procedures being used to assure that the intent of Section C2 of Regulatory Guide 1.29 has been met.

(3) The crane vendor is required to provide certificates of compliance for all load carrying members used in the fabrication of the crane.

(4) The welding procedures used to fabricated the crane have been reviewed.

4. New Fuel Elevator

The new fuel elevator includes the following safety features:

(a) The hoist is provided with integral motor brake and load brake and a geared limit switch with upper and lower limits. The switches automatically stop and apply the brake when the elevator reaches a predetermined upper and lower limit.

(b) The new fuel elevator is designed to withstand the safe shutdown earthquake without loss of structural integrity such that its failure cannot adversely affect stored fuel or safety-related seismic Category I equipment.

5. Cask Handling Crane

The cask handling crane includes the following safety features:

(a) Low voltage or no voltage for any motions automatically stops the motion and sets brakes.

(b) Limit switches are provided to stop the hook in its highest and lowest safe positions.

(c) The cask handling crane cannot travel over the spent fuel storage area or safety-related equipment other than Alternate Spent Fuel Pool Cooling System (ASFPC) components, described in Section 9.1.3. The ASFPC system is safety-related. Safe load path drawings administratively prohibit the travel of the cask handling crane loads over the ASFPC components when the system is in service. Cask handling crane loads over the ASFPC components are allowed only when the system is not in service.

(d) To assure that the design of the cask handling crane is adequate to withstand the safe shutdown earthquake without loss of structural integrity, the following measures have been implemented:

c. New Fuel Assembly Handling Tool and Spent Fuel Assembly Handling Tool

The acceptance test at the shop site includes the following:

1. The tools are load tested to 125 percent of the rated load.

2. The tools are assembled and checked for proper functional operation.

d. Fuel Transfer System

The acceptance test at the shop site includes the following:

The system is assembled and checked for proper functional and running operation.

e. Reactor Vessel Stud Tensioner

The acceptance test at the shop site includes the following:

The tensioner is assembled and checked for proper functional and running operation.

f. New Fuel Elevator

The new fuel elevator hoist is tested by the hoist manufacturer in accordance with ANSI B30.16. The new fuel elevator is assembled and checked for proper operation at installation and prior to use during refueling.

g. Spent Fuel Pool Bridge and Hoist

A loaded running test is performed prior to initial use of the crane in accordance with ANSI B30.2.

h. Cask Handling Crane

All hooks are shop tested at 1.5 times design rating. A longitudinal magnetic particle test is performed on the hooks both before and after the load test.

A no-load and loaded running test is performed in the field prior to initial use of the crane in accordance with ANSI B30.2.0.

i. Polar Gantry Crane

The crane bridge end trucks and bridge (without gantry legs) are completely assembled and wired in the shop prior to shipment, and a no-load running test of all motors is conducted.

All hooks are load-tested in the shop to 1.5 times design rating. A longitudinal magnetic particle test and ultrasonic inspection is performed on the hooks both before and after the load test.

A no-load and loaded running test was performed in the field prior to initial crane operation in accordance with ANSI B30.2.0. Also, the polar crane will be retested for the operating phase in accordance with NUREG-0612 requirements, as outlined in the PSNH report "Response to NRC Generic Request for Additional Information Relating to Control of Heavy Loads," dated May 1983, (UE&C Report No. 9763.006-S-N-5).

j. Head Lift Rig with New Lift Extensions (Simplified Head Modification)

The acceptance test at the shop site includes the following: The new extension members and clevis pins will be load tested to 300 percent of the maximum lift load, held for ten (10) minutes and followed up by nondestructive examination on the critical areas of the members.

The new extension members and clevis pin will be interconnected with the existing lift rig at the Seabrook site and proper fitup verified prior to use.

After completion of the modification a 100 percent load test and nondestructive examination per existing Seabrook Station procedures will be performed.

9.1.4.5 Instrumentation Requirements

The control systems for the refueling machine, spent fuel pool bridge and hoist, and Fuel Transfer System are discussed in Subsection 9.1.4.2c (component description). A discussion of additional electrical controls, such as the interlocks and main hoist braking system for the FHS, is found in Subsection 9.1.4.3a (Safe Handling).

9.1.5 Overhead Heavy Load Handling Systems

In response to NUREG-0612, New Hampshire Yankee submitted a final revised report to the NRC titled, "NUREG-0612, Control of Heavy Loads" dated October 31, 1985, (SBN-887). In the report New Hampshire Yankee committed to the principle of NUREG-0612, including an operator training program, periodic inspection and maintenance program for the cranes and identification of safe load paths for those loads that meet the NUREG-0612 criteria for a heavy load, (i.e., 2100 lbs. and greater). UFSAR Section 9.1.4, Fuel Handling System, describes the lifting equipment and structures used for the refueling operation that meet General Design Criteria 61 and 62 of 10 CFR 50, Appendix A and the requirements of NUREG-0612.

In North Atlantic's commitment to NUREG-0612, North Atlantic takes exception to testing requirements of ANSI N14.6-1978, "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More," as outlined in Section 5.3, "Testing to Verify Continuing Compliance." In particular, Section 5.3.1(2) states in part that "for special lifting devices that have not been used for greater than one year they will have NDE testing performed on major load-carrying welds and critical areas before returning the device to use."

Under this exception, North Atlantic will perform NDE testing on major load-carrying welds and critical areas of the Reactor Vessel Head Lift Rig and the Internals Lift Rig following the completion of their use in the outage prior to each 10 year ISI outage. If conditions dictate removal of the Lower Internals outside the normal schedule, the Internals Lift Rig shall receive the full inspection including NDE on completion of its use.

NRC Bulletin 96-02, "Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment," required utilities to review regulatory guidelines associated with the control and handling of heavy loads over spent fuel, over fuel in the reactor core, or over safety-related equipment while the unit is at power, (in all modes other than cold shutdown, refueling, and defueled). Administrative controls contained in North

TABLE 9.1-1
(Sheet 1 of 2)

SPENT FUEL COOLING AND CLEANUP SYSTEM DESIGN DATA

SYSTEM DESIGN DATA

System Cooling Capacity, Btu/hr	See Table 9.1-3
System Design Pressure, psig	150
System Design Temperature, °F	200
Boron Concentration, ppm	2,000 (minimum); 2,700-2,900 (nominal)

SAFETY CLASS COMPONENT DESIGN DATA

Components	Design Data	ANSI N18.2 Safety Class	Code
Spent Fuel Pool Cooling Pump			
Quantity	3	3	ASME III Class 3
Type	Horizontal, centrifugal		
Material	Stainless steel		
Flow (each), gpm	1100		
Head (each), ft	43		
Design pressure, psig	150		
Design temperature, °F	225		
Motor horsepower	20		
SFP Cooling Heat Exchanger			
Quantity	2 [1]	3	ASME III Class 3
Type	Counter flow		
Installation	Horizontal		
Design heat transfer rate, Btu/hr.	29.6×10^6 [21.9×10^6]		
Effective heat transfer area, ft^2	3037		

TABLE 9.1-1
(Sheet 2 of 2)

SPENT FUEL COOLING AND CLEANUP SYSTEM DESIGN DATA

Components	Design Data	ANSI N18.2 Safety Class	Code
Shell side - design			
Design pressure, psig	150		
Design temperature, °F	200		
Primary component cooling [Service Water] flow rate, gpm	3000 [3000]		
Primary component cooling [Service Water] water temperature (in.), °F	95 [85]		
Primary component cooling [Service Water] water temperature (out), °F	114.8 [99.6]		
Fouling factor, hr-ft^2 - F/Btu	0.0005		
Material	Carbon steel		
Tube side - design		3	ASME III Class 3
Design pressure, psig	150		
Design temperature, °F	200		
*Spent fuel pool water flow rate, gpm	2260		
Spent fuel pool water temperature (in.), °F	150 [140]		
Spent fuel pool water temperature (out), °F	123.2 [100]		
Fouling factor, hr-ft^2 - F/Btu	0.0005		
Material	Austenitic stainless steel		
Piping and Valves Associated With Fuel Pool Cooling			
Material	Stainless steel	3	ASME III Class 3
Design pressure, psig	150		
Design temperature, °F	200		

* Normal 1100 gpm/Design 2260 gpm

1. Alternate SFP Heat Exchanger data in [ ].

TABLE 9.1-3

SPENT FUEL POOL COOLING AND CLEANUP SYSTEM
DESIGN CONDITIONS

	NORMAL OPERATING CONDITIONS	
	Sixteen regions stored; both SFPHXs and pumps operating	Full Core Plus sixteen regions stored; both SFPHXs and pumps operating
Each Operating SFPHX		
Heat Load, 10^6 Btu/hr	7.8	23.44
SF Pump Flow, gpm	1100	1100
PCCW Flow, gpm	810 (1)	3000
Pool Temperature, °F (max.)	118	141

	ABNORMAL OPERATING CONDITIONS	
	Normal Power full core plus sixteen spent regions stored; both SFPHXs and two pumps operating with Cooling Tower as the ultimate heat sink	Normal Power full core plus sixteen spent regions stored; one SFPHX and two pumps operating with Atlantic Ocean as the ultimate heat sink
Each Operating SFPHX		
Heat Load, 10^6 Btu/hr	23.44	46.88
SF Pump Flow, gpm	1100	1100
PCCW Flow, gpm	3000	3000
Pool Temperature °F (max.)	154	166

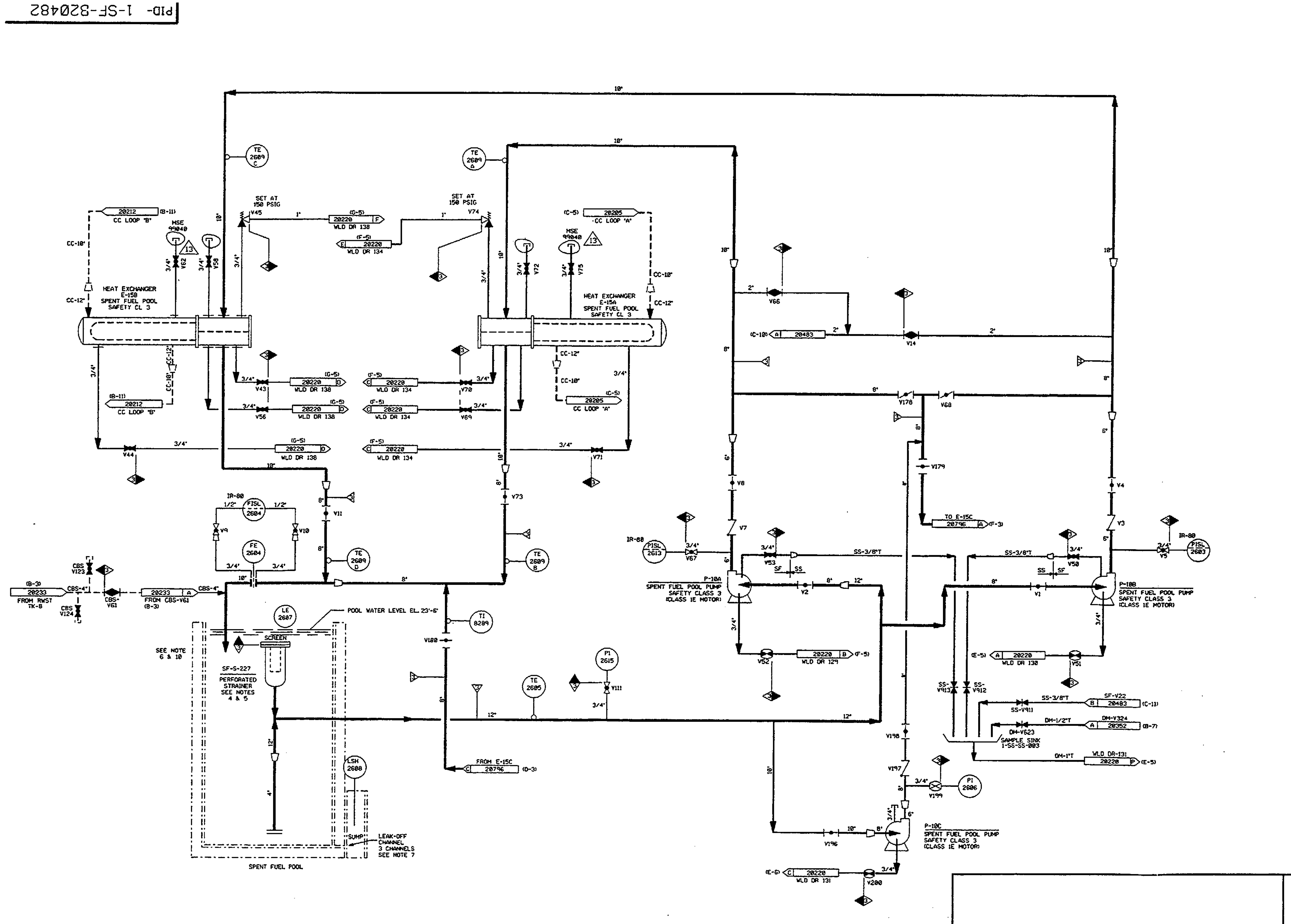
	ALTERNATE SPENT FUEL POOL COOLING (ASFPC) HEAT LOAD ADMINISTRATIVELY CONTROLLED ASFPCHX AND ONE PUMP OPERATING
Operating ASFPCHX	
Heat Load, 10^6 Btu/hr	21.9
SF Pump Flow, gpm	1100
SW Flow, gpm	3000
Pool Temperature °F (max.)	140

NOTE:
(1) Increased PCCW is available under this condition.

TABLE 9.1-4

(Deleted)

REV. 07



NOTES:

1. WORK THIS DRAWING WITH 20480, 20483 & 20484.
2. PIPING, VALVES, EQUIPMENT & INSTRUMENTS HAVE SYSTEM PREFIX "SF", UNLESS OTHERWISE NOTED.
3. VENTS, DRAINS AND TEST CONNECTIONS CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-805111 UNLESS NOTED OTHERWISE.
4. PROVIDE BLIND FLANGE; NECESSARY ONLY WHEN DEWATERING POOL. PIPE IS SAFETY CLASS 3; STRAINER IS CLASS NNS.
5. SUCTION IS LOCATED 2 FT BELOW THE NORMAL WATER LEVEL.
6. RETURN TERMINATES 11 FT ABOVE SPENT FUEL ASSEMBLIES.
7. PORTABLE PUMP IS USED TO REMOVE WATER AS REQUIRED FROM LEAK-OFF CHANNEL SUMP TO FLR DRAIN SUMP.
8. △ INDICATES REVISION LEVEL.
9. DELETED
10. EMERGENCY MAKE-UP TO SPENT FUEL POOL FROM THE CST USING TEMPORARY HOSE (CO-20426 G-7).

PORTIONS OF THIS DRAWING ARE

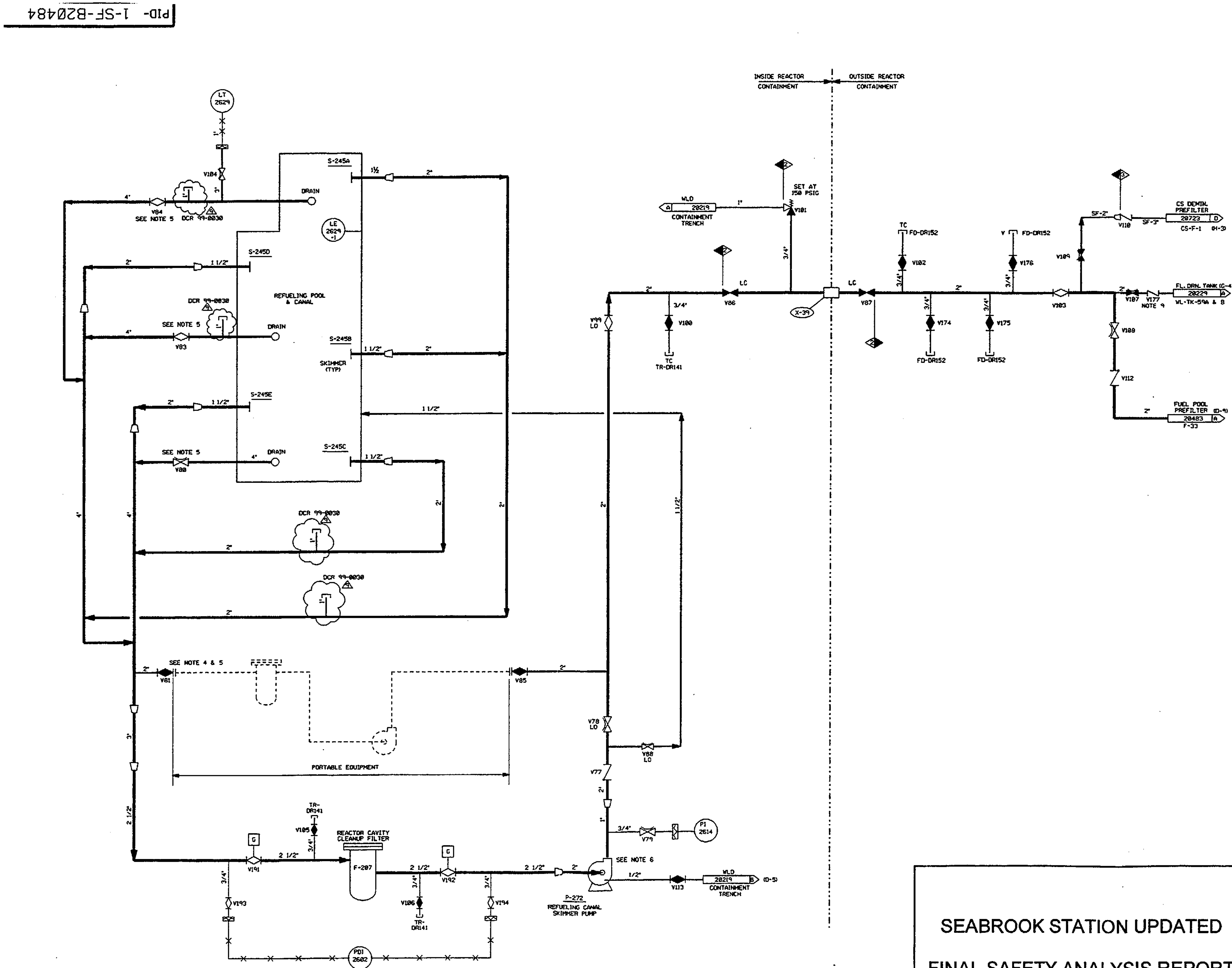
NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SPENT FUEL POOL COOLING AND CLEAN-UP SYSTEM DETAIL
1-SF-B20482	FIGURE 9.1-2 SH 1

08/03/99 REV. 13

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



NOTES:

1. WORK THIS DRAWING WITH 20480, 20482 & 20483.
2. ALL LINES, EQUIPMENT, COMPONENT & INSTRUMENTS HAVE SYSTEM PREFIX "SF", UNLESS NOTED OTHERWISE.
3. ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS ARE SAFETY CLASS NNS UNLESS NOTED OTHERWISE.
4. REMOVE BLIND FLANGE DURING PLANT POWER OPERATION. CLOSE VALVE & REPLACE BLIND FLANGE PRIOR TO REFUELING.
5. VALVE MUST BE LEFT OPEN DURING PLANT POWER OPERATION.
6. SEE DRAWING 20353 FOR MECHANICAL SEAL SUPPLY TO PUMP P-272
7. DELETED
8. △ INDICATES REVISION LEVEL.
9. 2" SPRING LOADED, PISTON STYLE CHECK VALVE.

PORTIONS OF THIS DRAWING ARE **NUCLEAR SAFETY RELATED**

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SPENT FUEL POOL COOLING AND CLEAN-UP SYSTEM DETAIL
	1-SF-B20484 — FIGURE 9.1-2 SH 3

Those portions of the PCCW system which furnish cooling water to safeguards components are designated Safety Class 3, seismic Category I, and are located in seismic Category I structures.

To provide increased reliability for cooling safety-related components, a crossconnect from the Fire Protection and Demineralized Water systems to the PCCW system is included in the system design. This crossconnect can be used to provide cooling water to the charging pump lube oil coolers or provide emergency makeup water to safety-related portions of the PCCW system. This crossconnect is backed up by a seismic Category I Service Water System and booster pump makeup source.

Protection of the PCCW system from wind and tornado effects is discussed in Section 3.3. Flood protection is discussed in Section 3.4. Missile protection is discussed in Section 3.5. Protection against the dynamic effects associated with postulated rupture in piping is discussed in Section 3.6.

9.2.2.2 System Description

a. Description

The flow diagrams for the PCCW system are shown in Figures 9.2-3 through 9.2-6 and 9.2-13. The PCCW system consists of the RCPTB loop and two independent flow loops, A and B, each of which supplies component cooling water to one of the redundant components performing engineered safeguard functions and to the RCPTB loop and to various nonsafeguard components. One of the two 100 percent (accident conditions) PCCW pumps connected in parallel supplies flow to each loop. One PCCW heat exchanger in loop A and one in loop B transfers the heat loads from the RCPTB loop and plant components to the Service Water System.

A single PCCW loop A or B pump providing flow to the PCCW heat exchanger in its loop is capable of removing the total heat during the recirculation phase following a loss-of-coolant accident occurring simultaneously with a loss of offsite electrical power.

There are four sets of RCPTB cooling coils which are cooled by the single PCCW RCPTB loop located inside the Containment Building. The RCPTB loop cooling water flow from one of two 100 percent capacity pumps flows through two 100 percent capacity series-connected heat exchangers, then flows through the four RCPTB cooling coils that are connected in parallel, then flows through a head/relief pipe and returns to the pump. Discharge throttling valves 3"-CC-V110, V114, V36 and V230 are open fully to backseat during RCPTB operation. The two heat exchangers remove heat from the thermal barrier loop; one heat exchanger being cooling by PCCW loop A and the other by PCCW loop B. The supply and return lines from the heat exchangers to loops A and B penetrate the containment wall. One containment isolation valve is placed on each of the four lines. The isolation valves remain open during a LOCA or MSLB event, and are closed manually in the event an abnormality is detected, such as leakage from the penetrations.

The two RCPTB pumps and heat exchangers provide redundancy. One pump is powered from the A train and the other from the B train. The standby pump is arranged to start automatically on low loop cooling tower spray bypass valves and fans are controlled manually from the MCB.

During severe winter operation, the cooling tower fans and spray bypass valves are manually controlled at the MCB, and provide control of the heat removal to prevent ice buildup in the cooling tower fill and basin.

The tower basin contains independent level transmitters which provide for indication, recording, and alarming of the basin level at the MCB. If there is a loss of level in the basin, the tower return lines contain flow indication which help the operator identify a failed line and permit its isolation. The tower basin level indication is safety-related. This indication provides operator information regarding proper operation of the ultimate heat sink.

9.2.6 Condensate Storage Facility

9.2.6.1 Design Bases

The condensate storage facility design bases are:

a. To provide makeup capacity to compensate for changes in the water inventory of the Steam and Power Conversion System during normal operation and transient conditions.

b. To maintain sufficient water storage to satisfy the requirements of the Emergency Feedwater System (EFS) during all periods of plant operation.

c. To meet the requirements of the General Design Criteria regarding seismic and tornado protection.

9.2.6.2 System Description

The condensate storage facility is shown in Figures 10.4-6 and 10.4-7. It consists of the condensate storage tank, the condensate transfer pump, the condensate storage tank heat exchanger, and all associated piping.

The condensate storage tank is fabricated from stainless steel, and is located outdoors in the yard area, adjacent to the Turbine Building. The tank is equipped with a stainless steel floating cover to preclude excessive oxygenation in the contained water. Except for the tank roof, it is completely encircled by a reinforced concrete wall that provides tornado missile protection. The tank is vented to the atmosphere and has a total capacity of approximately 400,000 gallons at the overflow connection. Half of this capacity is maintained for use by the Emergency Feedwater System, while the remainder acts as makeup capacity for the Condensate System. All non-seismic tank connections are physically located at a

A missile which hits the pan-shaped floating cover will render it unable to hold water on top. A missile which punctures the top of the condensate storage tank above the missile barrier and exits below the invert of nozzle B (El. 44'-4-3/8") will also hit the floating cover. Therefore, the greater of the two scenarios is postulated, i.e., the loss of 3,940 gallons.

Since at the initial tank elevation, 204,240 gallons are available for EFW supply, this leaves over 200,000 gallons designated for EFW use.

Each of the redundant EFW lines has at its origin inside the CST a piping tee. This tee will give two possible flow paths to each of the redundant EFW lines. These EFW nozzles are located approximately 10 feet apart. The entire surface of the floating cover deck is covered with polyethylene foam which prevents sinking should water flood the pan shaped cover. Debris would have to block more than 50 percent of both ends of each EFW connection in order to restrict sufficient flow from reaching the EFW pumps.

The environmental effects of a tank failure would be inconsequential due to the containment of the released water. As a result, there are no specific limitations of radioactivity concentrations for a rupture associated accident of this tank.

With the exception of the condensate storage tank, the suction piping from the tank to the emergency feed pumps, and the EFW pump(s) recirculation line, the condensate storage facility is not required for plant safety. It is not expected to contain any radioactive contamination during normal operation. Radioactive contamination can only occur through carry-over of radioactivity during a surge in the condensate system which results in recirculation from the condensate or startup feed pump discharge to the condensate storage tank, when a steam generator tube leak exists. Due to the radioactive monitoring which is provided, and the length and complicated path that the contaminated condensate must take prior to its settling in the CST, the level of activity expected is low and, in any event, will be contained within the plant boundaries. See Section 11.2 for expected levels of contamination.

The EFW system is designed to operate continuously to effect cooldown to RHR system cut-in. Based on a cooldown rate of 50°F/hr., this cooldown will require 4.85 hours of operation, in addition to the four-hour period at hot shutdown. The total quantity of decay heat integrated over a 9-hour period following a postulated accident is 1020×10^6 Btu. Considering pump heat, reactor coolant heat, metal heat and steam generator inventory, the total heat to be removed is 1460×10^6 Btu. Based on EFW supply at 100°F, a total of 156,200 gallons is required. The dedicated EFW supply in the CST is 200,000 gallons. For a discussion of EFW system operation with an assumed single failure, see Subsection 6.8.3 and Table 6.8-2. The entire usable volume of the CST (370,000 gallons if full) would be available for EFW supply. Also, the contents of the condenser hotwells and the demineralized water storage tank (nonsafety-related) could be utilized through nonsafety-related pumps and interconnecting piping.

For Station Blackout, EFW will operate during the four-hour coping duration to cool down and maintain the secondary side pressure at about 250 psig (see Section 8.4.4.1). The amount of CST water required to support this operation is 131,137 gallons, including consideration of decay heat removal, sensible heat removal and steam generator level shrinkage. This is less than the CST 200,000 gallon dedicated EFW supply.

TABLE 9.2-16

REACTOR MAKEUP WATER SYSTEM EQUIPMENT DATA

A. Reactor Makeup Water Pumps

Number	2
TDH at Capacity (each)	360 feet at 150 gpm; 270 feet at 280 gpm
Material	Austenitic Stainless Steel (316 SS)
Design Pressure	200 psig
Design Temperature	150°F
Design Code	ANSI B73.1
Safety Class	NNS

B. Reactor Makeup Water Storage Tank

Number	1
Capacity	112,000 gallons
Material	Austenitic Stainless Steel
Design Pressure	Atmospheric
Design Temperature	150°F
Design Code	API 650
Safety Class	NNS

C. Piping and Valves

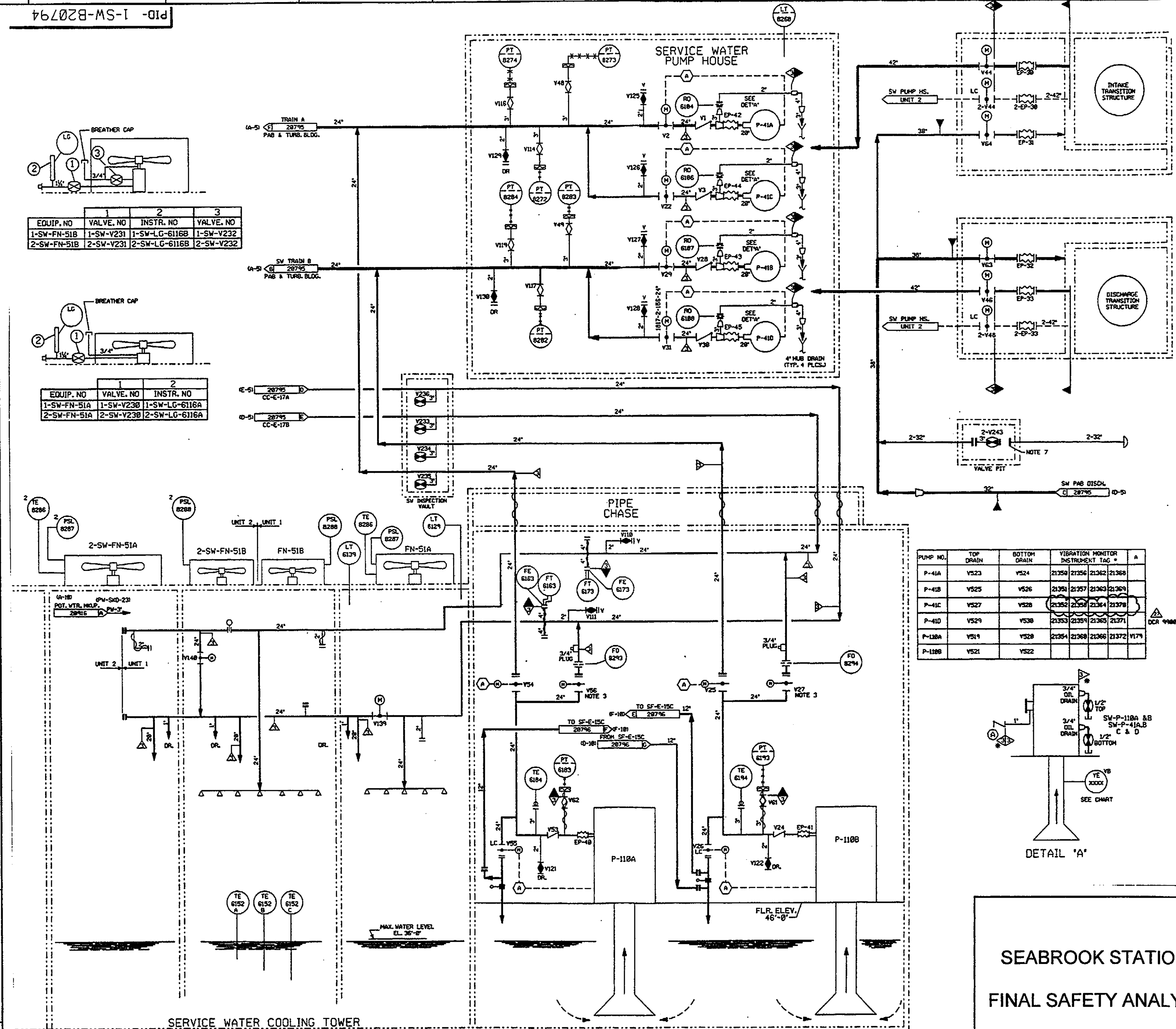
Material	Austenitic Stainless Steel
Design Pressure	200 psig
Design Temperature	150°F
Design Code	ANSI B31.1.0, ASME III
Safety Class	NNS and Safety Class 2 & 3

D. Containment Isolation Piping Valves

Material	Austenitic Stainless Steel
Design Pressure	250 psig
Design Temperature	150°F
Design Code	ANSI B31.1.0, ASME III
Safety Class	NNS and Safety Class 2

TABLE 9.2-17

(Deleted)



	1	2	3
EQUIP. NO	VALVE. NO	INSTR. NO	VALVE. NO
1-SW-FN-51B	1-SW-V231	1-SW-LG-6116B	1-SW-V232
2-SW-FN-51B	2-SW-V231	2-SW-LG-6116B	2-SW-V232

	1	2
EQUIP. NO	VALVE. NO	INSTR. NO
1-SW-FN-51A	1-SW-V230	1-SW-LG-6116A
2-SW-FN-51A	2-SW-V230	2-SW-LG-6116A

PUMP NO.	TOP DRAIN	BOTTOM DRAIN	VIBRATION MONITOR INSTRUMENT TAG *				A
P-41A	V523	V524	21350	21356	21362	21368	
P-41B	V525	V526	21351	21357	21363	21369	
P-41C	V527	V528	21352	21358	21364	21370	
P-41D	V529	V530	21353	21359	21365	21371	
P-110A	V519	V520	21354	21360	21366	21372	V179
P-110B	V521	V522					

27 DCR 990028

REV. 07

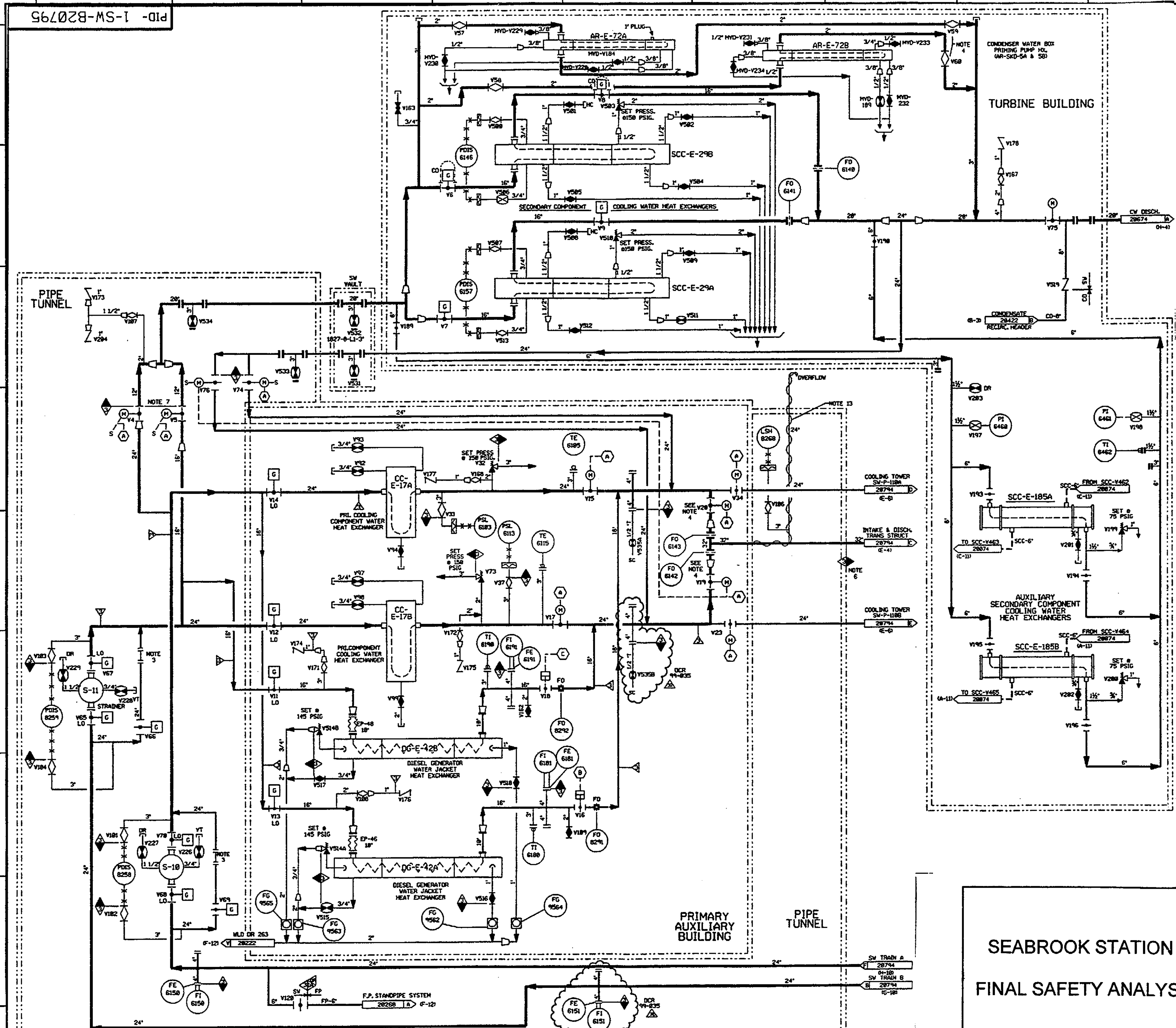
FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20792 THRU 20796.
2. ALL PIPING, VALVES, EQUIPMENT & INSTRUMENTS HAVE SYSTEM PREFIX "SW", AND 1 FOR UNIT-1 UNLESS NOTED OTHERWISE.
3. VALVES 1-SW-V27 AND V56 ARE PRESET. THESE ARE THE ONLY VALVES TO BE USED FOR FLOW BALANCING WHEN REQUIRED.
4. DELETED
5. △ INDICATES REVISION LEVEL
6. VENTS, DRAINS AND TEST CONNECTION CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-805111, UNLESS NOTED OTHERWISE.
7. PLATE WELDED TO PIPE TO MAINTAIN CLEANLINESS AND FOREIGN MATERIAL EXCLUSION.
8. INSTRUMENTATION REFERENCES:
   (A) TA LOGIC

PORTIONS OF THIS DRAWING ARE
NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SERVICE WATER SYSTEM NUCLEAR DETAIL	
	1-SW-B20794	FIGURE 9.2-2 SH 1



REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID-LEGEND 1 AND P&ID-LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20792 & 20794.
2. ALL PIPING, VALVES, EQUIPMENT, & INSTRUMENTS HAVE SYSTEM PREFIX "SW" UNLESS NOTED OTHERWISE.
3. SPOOL PIECE NECESSARY FOR ADDITIONAL SERVICE WATER STRAINER AT LATER DATE (IF REQUIRED).
4. VALVES 1-SW-V19, 20, 59 AND V60 ARE PRESET. THESE ARE THE ONLY VALVES TO BE USED FOR FLOW BALANCING, WHEN REQUIRED.

6. CLASS BREAK OCCURS WHERE PIPE ENTERS EARTH.
7. VALVES V4 & V5 TO CLOSE ON COMPLETE LOSS OF OFF SITE POWER.
8. XX - DENOTES TITANIUM MATERIAL.

9. DELETED
10. △ INDICATES REVISION LEVEL
11. INSTRUMENTATION REFERENCES
    - (A) TA LOGIC
    - (B) OPEN CMD FROM DG-1A
    - (C) OPEN CMD FROM DG-1B
12. VENTS, DRAINS AND TEST CONNECTION CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-805111, UNLESS NOTED OTHERWISE.
13. HEAT TRACING HAS BEEN DISCONNECTED AND IS NON-FUNCTIONAL.

PORTIONS OF THIS DRAWING ARE

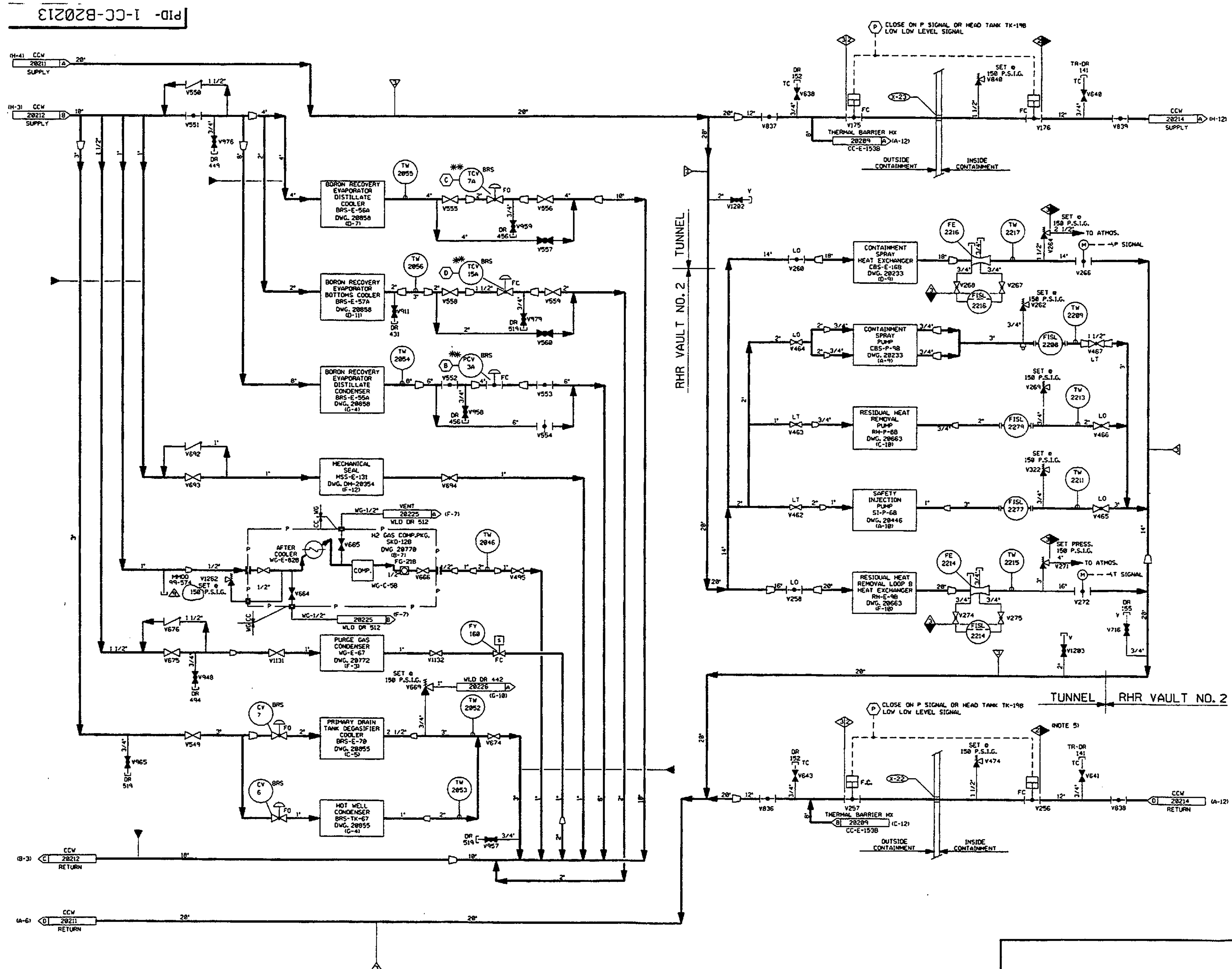
NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SERVICE WATER SYSTEM NUCLEAR DETAIL	
	1-SW-B20795	FIGURE 9.2-2 SH 2

01/26/01 REV. 32

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



NOTES:

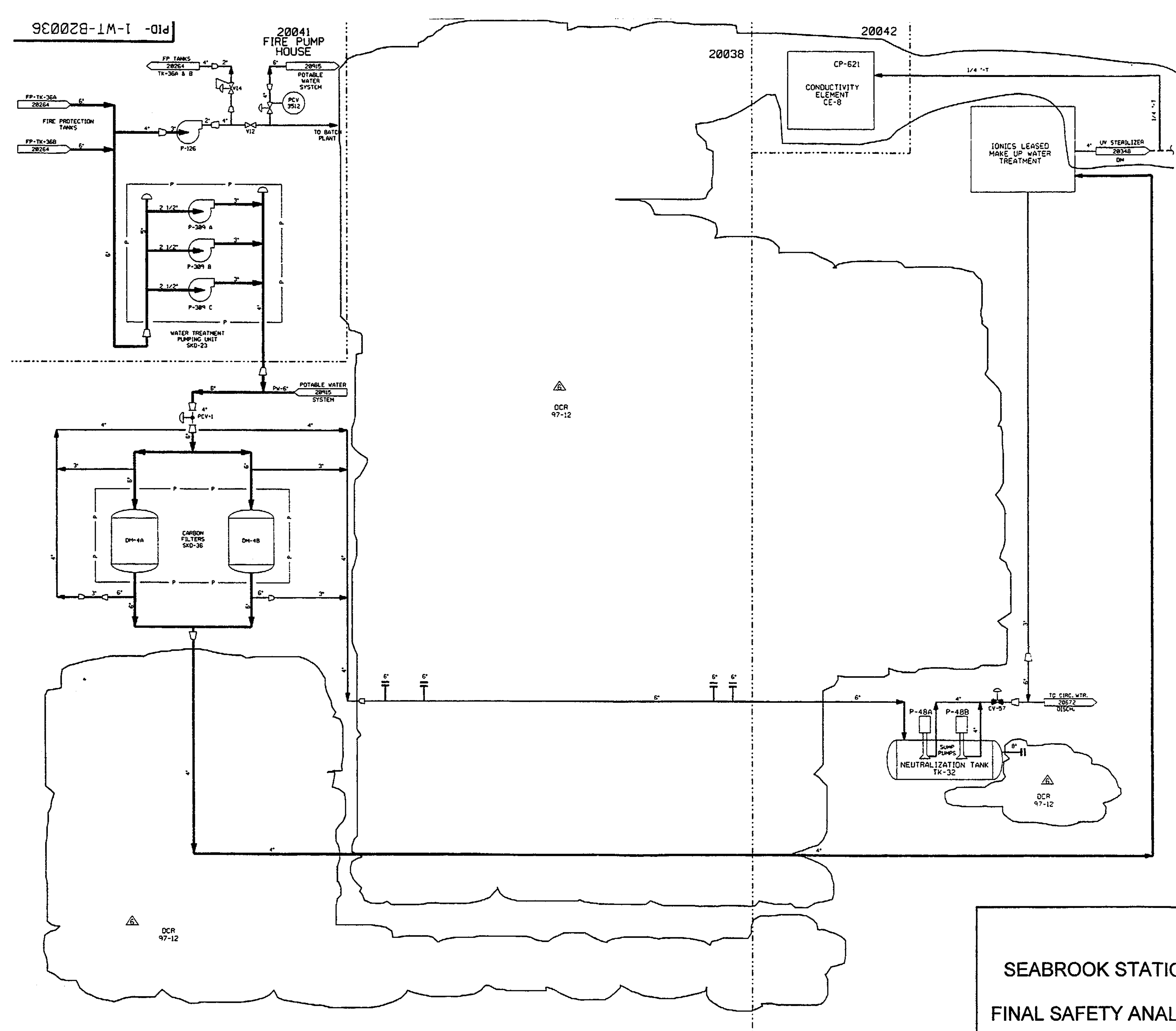
1. WORK THIS DRAWING WITH DRAWINGS 20204 THRU 20215.
2. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX 1-CC UNLESS NOTED OTHERWISE.
3. INSTRUMENT REFERENCES
   - (B) FROM BRS-PT-3A DWG. 20858
   - (C) FROM BRS-TE-7A DWG. 20858
   - (D) FROM BRS-TE-15A DWG. 20858
4. VENT & DRAIN CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-805111 UNLESS OTHERWISE NOTED.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	PRIMARY COMPONENT COOLING LOOP B DETAIL
	1-CC -B20213 / FIGURE 9.2-6 SH 3

REV. 07



NOTES:
1. WORK THIS DRAWING WITH DRAWINGS 20038 THRU 20041 AND 20042.
2. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTS HAVE SYSTEM PREFIX WT, UNLESS NOTED OTHERWISE.
3. △ - INDICATES REVISION LEVEL

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

WATER TREATMENT OVERVIEW

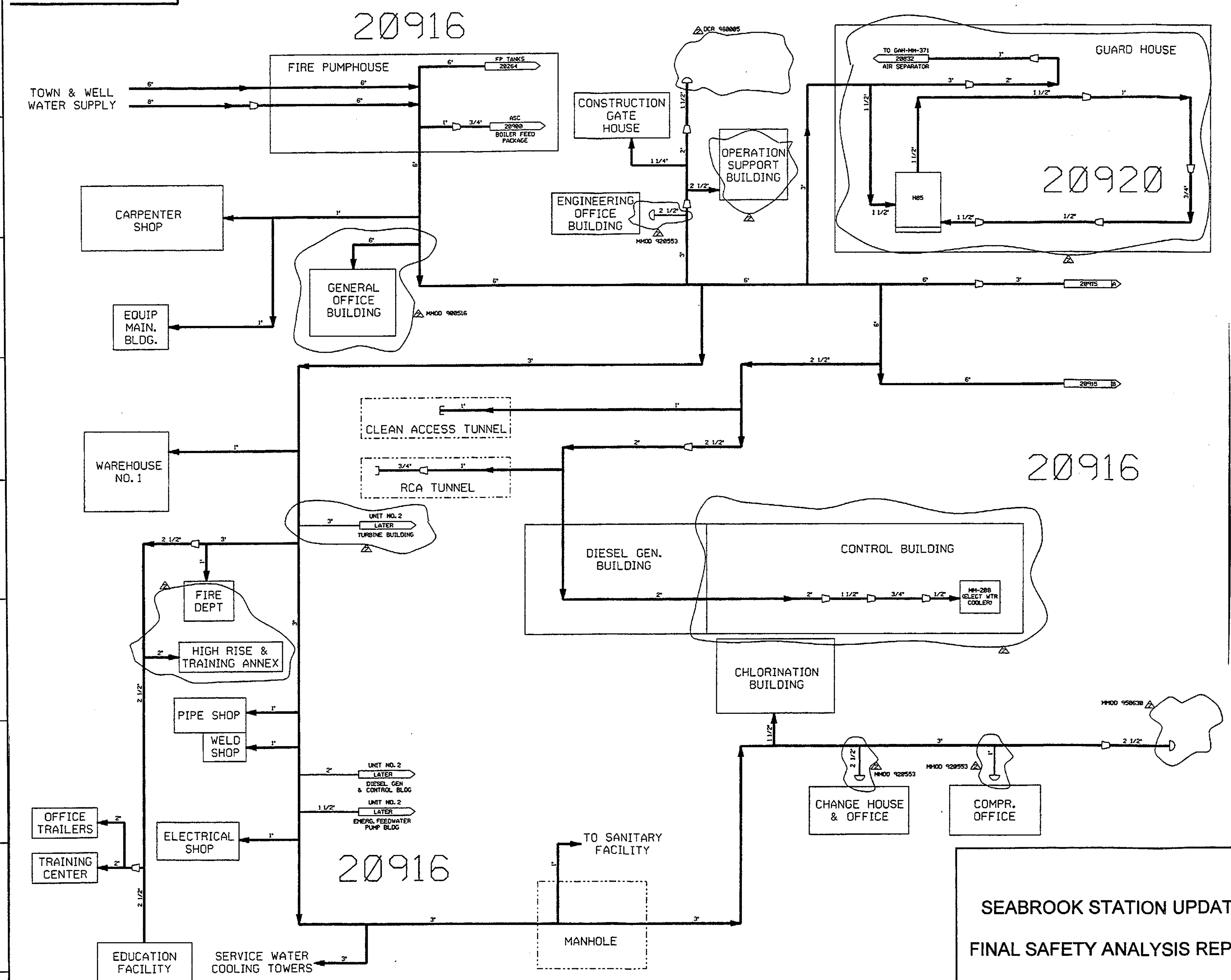
1-WT-B20036

FIGURE 9.2-8

07/23/99 REV. 06

PID- 1-PW-B20914

REV. 07



NOTES:

1. WORK THIS DWG. WITH DWGS. 20915 THRU 20920.
2. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX PW UNLESS NOTED.
3. △ INDICATES REVISION LEVEL.

REF. DRAWING NO.	REV	TITLE
9763-F-604462	3	CHLOR BLDG DRNG FIRE PROT & POT WTR
9763-F-604141	13	EMERG FDWTR PUMPHSE FIRE PROT & POT WTR
9763-F-604107	14	DIESEL GEN BLDG DRAINAGE SYS
9763-F-604099	13	CONTROL BLDG STORM, SANITARY, & POT WTR
9763-F-604076	14	POTABLE WATER SYSTEM P&ID
9763-F-604069	18	YARD & FIRE PUMPHOUSE FIRE PROTECTION
9763-F-604059	18	FIRE PUMPHOUSE HTG & VENT PLAN & P&ID

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

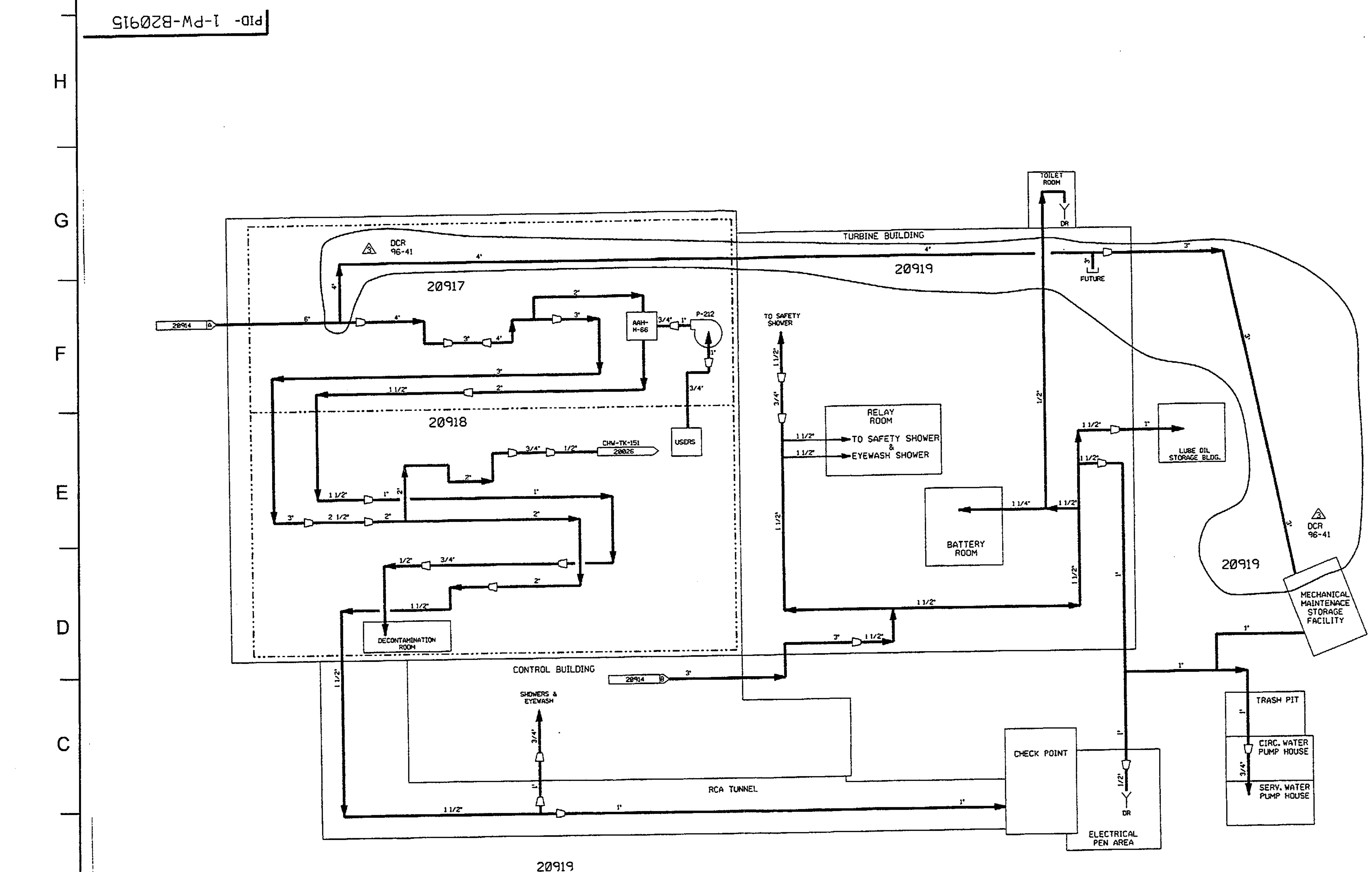
POTABLE WATER OVERVIEW SH 1

1-PW-B20914

FIGURE 9.2-9 SH 1

01/26/01 REV. 02

REV. 07



NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20914, 20916 THRU 20920.
2. ALL LINES, EQUIPMENT, COMPONENT AND INSTRUMENTATION HAVE SYSTEM PREFIX PW, UNLESS NOTED OTHERWISE.
3. △ INDICATES REVISION LEVEL.

REF. DRAWING NO.	REV	TITLE
9763-F-604099	14	CON. BLDG STRM, SANITORY & POT WTR PIPING
9763-F-615030	6	ADMIN & SERV BLDG, PLUMBING SPECIAL WASTE
9763-F-604462	14	CHLOR BLDG DRAIN, FIRE PROT, POT WTR SECT DETAI
9763-F-615032	4	ADMIN & SERV BLDG PLUMB POT WTR FLOW DIA
9763-F-604141	14	EMERG FDWTR PUMP BLDG HTR & VENT SYS PLANS
9763-F-604100	7	ELEC TUNNELS & UP & LOWER LEVELS, DRAINAGE FIRE PR
9763-F-604459	11	SERV. & CIRC PUMP HOUSE DRAINAGE SYS.
9763-F-604076	18	POTABLE WATERSYSTEM PIPING DIAGRAM

SEABROOK STATION UPDATED

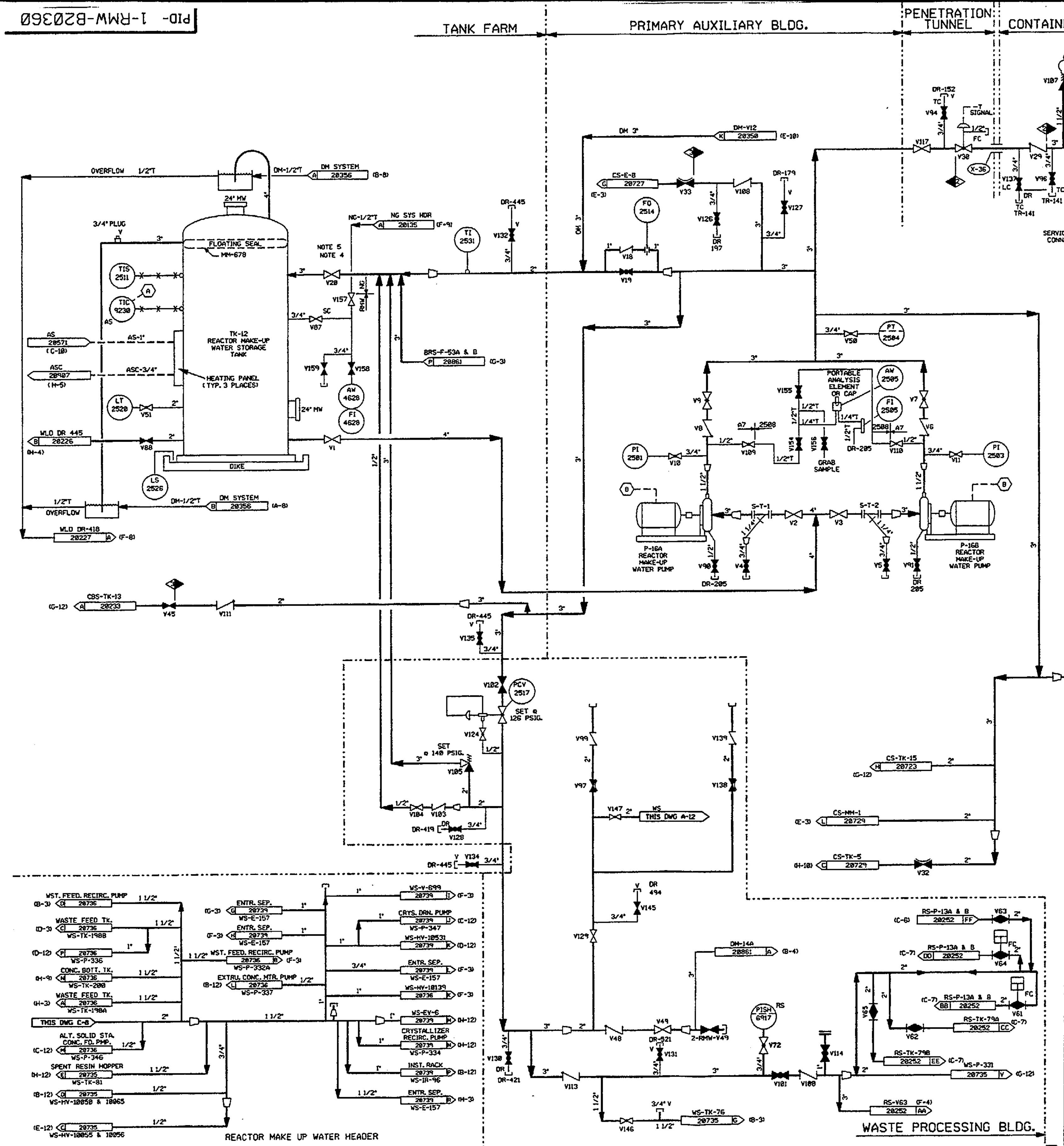
FINAL SAFETY ANALYSIS REPORT

POTABLE WATER OVERVIEW SH 2

1-PW-B20915

FIGURE 9.2-9 SH 2

09/17/99 REV. 03



REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. RMW IS A ONE DRAWING SYSTEM, AN OVERVIEW IS NOT REQUIRED.
2. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX RMW, UNLESS NOTED OTHERWISE.
3. INSTRUMENTATION REFERENCE SYMBOLS:
   (A) TO AS-TY-9230 ON DWG. 20571.
   (B) FROM REACTOR COOLANT MAKE-UP CONTROL
4. V20 INTERNALS HAVE BEEN REMOVED SO THAT V105 CANNOT BE ISOLATED.
5. VALVE V20 IS LOCATED OUTSIDE DIKE.
6. △ - INDICATES REVISION LEVEL.
7. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS, UNLESS NOTED OTHERWISE.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	REACTOR MAKE-UP WATER SYSTEM	
	1-RMW-20360	FIGURE 9.2-11

Type Sample	System	Origin
Grab	Chemical and Volume Control System	Letdown Heat Exchanger
Grab	Chemical and Volume Control System	Cation and Mixed Bed Demineralized
Grab	Chemical and Volume Control System	Letdown Degasifier Trim Cooler
Grab	Chemical and Volume Control System	Thermal Regeneration Demineralizer
Grab	Residual Heat Removal	Residual Heat Removal Heat Exchanger
Grab	Demineralized Water	Demineralizer
Sample Vessel	Chemical and Volume Control System	Chemical and Volume Control Tank
Sample Vessel	Chemical and Volume Control System	Letdown Degasifier

Local sample points of other auxiliary systems are shown in the figures of their respective Updated FSAR sections, as listed below:

Sample Source	Updated FSAR Section
Refueling Water Storage Tank	6.2.2
Accumulators	6.3.2
Boric Acid Tank	9.3.4
Boric Acid Batching Tank	9.3.4
Primary Drain Tank Degasifier	9.3.5
Chemical Mixing Tank	9.3.4

Spent Fuel Pool	9.1.3
Containment Sumps	9.3.3
Containment Atmosphere	6.2.5
Condensate and Feedwater	10.4.7
Steam Generator Blowdown/ Demineralization System	10.4.8
Gas Waste System	11.3.2
Release Recovery Tanks	9.3.5, 9.3.4

Other sample points are given in Table 11.5-3.

4. Secondary Steam and Water Sampling Subsystem (SSW)

The SSW subsystem monitors the quality of steam and water at designated sample points, as shown if Figure 9.3-15. Sampling, in general, is done on a continuous basis, with the additional capability of grab sampling for laboratory analysis. Each sample is representative, with properly designed sampling nozzles used wherever required. To preclude interference by foreign material (e.g., rust, scale, dirt, etc.), a routine sample purge is performed prior to bringing a sample in line.

For proper analyzer operation and safety, the pressure of each sample is reduced at the sample panel and, if required, the sample is adequately cooled.

Deviations of measured quantities from specified values are alarmed at a local panel in the Turbine Building.

In the event of leakage of reactor coolant into the secondary system, radioactivity may be present in the SSW samples. A radiation alarm from the steam generator blowdown sampling subsystem radiation monitors alerts personnel to potential primary to secondary leak conditions.

5. Post-Accident Sampling Subsystem

The post-accident sampling subsystem provides the capability to obtain liquid samples from reactor coolant loops 1 and 3, The reactor coolant sampling line used during post-accident operation branches off the common line from loops 1 and 3 inside the Primary Auxiliary Building. This line bypasses the sample heat exchangers and runs through the post-accident sample heat exchanger and onto the post-accident sample panel.

The configuration of the containment isolation valves on the sample lines from the reactor coolant loops 1 and 3 and the power supply arrangement to these valves ensure that a reactor coolant sample can be obtained in the event of a power train failure.

The valving on the post-accident sample panel is operable through a shield wall behind which the panel is mounted. The post-accident sample system heat exchanger cools the sample being taken with PCCW from Train A. A water bath on the panel will provide additional cooling, if required. The panel provides the capability to extract a gaseous or diluted liquid sample with a syringe for laboratory analysis. After a sample has been removed for analysis, the sample panel can be flushed with demineralized water which is retained in a flush tank before being returned to the containment. This return line is provided with automatic ESFAS isolation valves. Gases from the flush tank and the sample panel are routed to the Primary Auxiliary Building vent system for cleanup.

The analyses performed on Reactor Coolant System samples include boron content, chloride content, and gamma spectrum.

Samples from the containment recirculation sumps are taken from the discharge lines of the residual heat removal pumps RH-P-8A and RH-P-8B, which draw through valves CBS-V8 and CBS-V14. In order to sample either of the two sumps, each sample line is provided with a remotely operated diaphragm valve before joining together in a common header leading to the post-accident sample panel.

The ECCS pump room sumps sampled during post-accident operation are the Primary Auxiliary Building sump "A" and the sumps in RHR/CBS equipment vaults 1 and 2. These sumps are sampled to detect any radioactive releases which would result from equipment leakage. Sample pumps send the samples to the post-accident sample panel. The discharge of each sample pump has a backpressure regulating valve which vents back to its sump to protect against overpressurization.

Diluted samples from the containment recirculation sumps and the ECCS pump room sumps are analyzed for boron content, chloride content and gamma spectrum.

Gas samples of the containment atmosphere are obtained by bypassing the flow to the hydrogen analyzers through sample vessels, which are equipped with quick-disconnect couplings with integral or built-in poppet-type check valves and integral isolation valves. Once a sample is taken, the sample vessel is removed and its contents are analyzed for hydrogen content and gamma spectrum.

All electrically powered equipment (i.e., solenoid valves and sample pumps) whose operation is required to perform post-accident sampling is powered from an emergency backup power source.

b. Equipment Location and Description

The system equipment is situated at five locations:

1. The sample heat exchangers, sample sink, sample panel, post-accident sample panel, flow control valves, reach rod-operated valves and local flow, temperature and pressure indicators for the reactor coolant, post-accident and other auxiliary systems sampling subsystems are located on the grade level of the Primary Auxiliary Building.

2. The steam generator blowdown sample panel and grab sample are located on a raised platform on the west side of the sample heat exchanger room.

3. The capillary tubes on the pressurizer steam and liquid space sample lines are located inside the missile barrier in containment.

4. The sample vessels for containment atmosphere are located on grade level in the hydrogen analyzer area of the main steam and feedwater pipe chase on the east side of containment.

5. The secondary steam and water sampling subsystem equipment and components are located in the Turbine Building.

The equipment design parameters for the reactor coolant, steam generator blowdown, post-accident sampling and other auxiliary systems sampling subsystems are summarized in Table 9.3-2.

9.3.2.3 Safety Evaluation

The sample system has no emergency or safety function, nor is its performance required to prevent an emergency condition.

Isolation of those samples originating within the containment is accomplished by:

a. Manual valves near the sample points

b. Electrically operated solenoid valves which automatically close on a containment isolation signal, or can be closed by remote manual switches on the main control board

c. Manual valves at the sample sinks.

9.3.2.4 Tests and Inspections

The system is operationally tested and samples drawn including appropriate purging from each sample point.

9.3.2.5 Instrumentation and Control

Local instrumentation for monitoring pressures, temperatures, and flows is provided in the sample sink area and at the sample panel in the Turbine Building to provide for safe manual operation and to verify sample flows.

The four steam generator blowdown sample lines are continuously monitored for radioactivity. If a high radioactive level is detected, alarms are triggered on the local panel, the RDMS computer and in the control room. In addition, the blowdown flash tank discharge line is automatically isolated if the alarm setpoint on RM6519, or any of the individual blowdown monitors is exceeded.

Administrative overrides allow blowdown flow to continue after isolation of the system, for evaporation processing and/or sampling on an individual line basis. See Subsection 10.4.8 for additional information on blowdown system operation.

The steam generator blowdown portion of the system also contains cation conductivity and sodium process instruments to monitor for condenser leakage. Each steam generator blowdown line is monitored separately. A high conductivity and high sodium sample is alarmed at the sample control panel and at the main control board.

Sample system lines penetrating the containment have appropriate containment isolation valves which automatically close on a "T" (Phase A containment isolation) signal and also fail closed. These valves, being safety-related, are also controlled from the main control board. See Section 7.3 and Subsection 6.2.4 for additional information on containment isolation.

Globe-type valves are used for interior containment isolation. The interior and exterior isolation valves are equipped with operators for automatic or remote operation. The valves are actuated by a containment isolation signal or manually from the control room. See Subsection 6.2.4 for the types of operators used and discussion of containment isolation signal.

Measured quantities from the secondary steam and water sampling subsystems are indicated and/or recorded at local panels in the Turbine Building.

8. Emergency Feedwater Pump Building

The Emergency Feedwater Pump Building has five 4" floor and two 2½" floor drains which lead into a 4" drain line to an oil separator. The inlet to the oil separator has a device which limits the inlet flow to 75 gpm.

9.3.3.3 Safety Evaluation

The Equipment and Floor Drainage System is operable during all normal modes of operation. The entire system is classified as NNS, nonseismic Category I, non-Class 1E, with the exception of piping runs through the containment walls, and the isolation valves for these penetrations.

Should a malfunction occur in the drainage system resulting in leakage from the drainage system (e.g., drain line leak, holdup tank overflow or rupture, pump seal leak, etc.), the fluid is collected in a local floor drain sump.

For the Emergency Feedwater Pump Building, piping failures were considered in the hot water heating, emergency feedwater and the Fire Protection Systems. The worst case break was in the 8" diameter emergency feedwater pump discharge header. Since the Emergency Feedwater System is at standby during normal plant operating conditions, the break postulated was a through-wall leakage crack, as required for moderate energy systems. Flow from the ruptured pipe, driven by the elevation head of the condensate storage tank is 80 gpm.

The maximum safe allowable flooding of the Emergency Feedwater Pump Building is 8 inches.

Even if credit is not taken for the 75 gpm capacity of the drain system, the total flood in the Emergency Feedwater Pump Building is less than 3 inches, considering forty minutes for corrective operator action.

The three charging pump cubicles are located at Elevation 7'-0" in the PAB. The floor and equipment drains from all three cubicles connect into a common drain header (see Figure 9.3-21, Sheet 2). High energy line breaks in the pump discharge line and moderate energy line breaks in the pump suction line have been evaluated for the potential impact on the safe shutdown of the plant. This evaluation has assumed a blockage in the common drain header so that leakage from one cubicle could back up into the other two cubicles, i.e., resulting in flooding in all three cubicles. Blockages in the drain lines from an individual cubicle have also been evaluated.

For either a high energy or moderate energy line break in any one charging pump cubicle, there are several Chemical and Volume Control System alarms generated as a result of the break that alert the operators to the condition. These alarms allow the operators to take action either in the Control Room or locally in time to prevent the loss of all three charging pumps even assuming a random single active failure of one of the charging pumps to start.

The four column PCCW pumps at elevation 25'-0" in the PAB are not enclosed. The floor supporting the PCCW pumps has numerous drains and openings (doorways, grating, etc.) leading to the lower floor levels. Thus it is very improbable that this floor would be flooded to a depth which would make the PCCW pumps inoperable.

The following nonseismic Category I tanks are also located at discrete elevations in the PAB:

Elevation	Tank	Tag No.	Volume (gal.)
53'-0"	Blowdown Flash	SB-TK-40	650 (automatically isolated)
53'-0"	Boric Acid Batch	CS-TK-5	1500 (normally empty)
25'-0"	Chiller Surge	CS-TK-3	587
7'-0"	Degasifier	CS-SKD-32	370
			~3100 gallons, total

The small volume of liquids in the above tanks does not pose a serious flooding problem. If all of the above tanks ruptured, the flooding depth would only be approximately 0.5 inches.

Two high-pressure letdown valves are provided in parallel, either of which can be utilized to adjust letdown flow from 0 to 80 gpm.

Reactor coolant is discharged to the CVCS from a reactor coolant loop cold leg; it then flows through the shell side of the regenerative heat exchanger where its temperature is reduced by heat transfer to the charging flow passing through the tubes. The coolant then experiences a large pressure reduction as it passes through the high pressure letdown control valve. During normal operation, failed fuel detection is provided by the reactor coolant letdown gross activity radiation monitor located adjacent to the letdown line, prior to the letdown heat exchanger. For a further discussion, refer to Section 11.5, Process and Effluent Radiological Monitoring and Sampling System. The coolant then flows through the tube side of the letdown heat exchanger where its temperature is further reduced to the operating temperature of the mixed bed demineralizers. Downstream of the letdown heat exchanger, a second pressure reduction occurs. This second pressure reduction is accomplished with the low pressure letdown valve, which maintains upstream pressure and thus prevents flashing downstream of the high pressure letdown valves. The coolant then flows through the demineralizer pre-filter and one of the mixed bed demineralizers.

Three charging pumps (one positive displacement, and two centrifugal) are provided to take suction from the volume control tank and return the purified reactor coolant to the RCS. Normal charging flow is handled by one of the three charging pumps. This charging flow splits into two paths. The bulk of the charging flow is pumped back to the RCS cold leg through the tube side of the regenerative heat exchanger. The letdown flow in the shell side of the regenerative heat exchanger raises the charging flow to a temperature approaching the reactor coolant temperature. Two redundant charging paths are provided from a point downstream of the regenerative heat exchanger. Either path may be used, and service may be alternated between the two to decrease the transients experienced. Also, a flow path is provided from the regenerative heat exchanger outlet to the pressurizer spray line. An air-operated valve in the spray line is employed to provide auxiliary spray to the vapor space of the pressurizer during plant cooldown. This provides a means of cooling the pressurizer near the end of the plant cooldown when the reactor coolant pumps, which normally hydrogen atmosphere with nitrogen, and by continuous purging to the Gaseous Waste Processing System.

Core reactivity is controlled during the cooldown by adding borated water to RCS in conjunction with cooldown to achieve minimum shutdown margin as specified in Technical Specifications and Core Operating Limits Report. After the boration is completed and reactor coolant samples verify that the concentration is correct, the operator resets the Reactor Makeup Control System for leakage makeup and remaining system contraction at the shutdown reactor coolant boron concentration.

Contraction of the coolant during any remaining cooldown of the RCS results in actuation of the Pressurizer Level Control System to maintain normal pressurizer water level. The charging flow is increased, relative to letdown flow, and results in a decreasing volume control tank level. The volume control tank level controller automatically initiates makeup to maintain the inventory.

After the RHRS is placed in service and the reactor coolant pumps are shutdown, further cooling of the pressurizer liquid is accomplished by charging through the auxiliary spray line. Coincident with plant cooldown, a portion of the reactor coolant flow is diverted from the RHRS to the CVCS for cleanup. Demineralization of ionic radioactive impurities and stripping of fission gases reduce the reactor coolant activity level sufficiently to permit personnel access for refueling or maintenance operations.

3. <u>Reactor Makeup Control System</u>

The Reactor Makeup Control System can be set up for the following modes of operation:

(a) <u>Automatic Makeup</u>

The "automatic makeup" mode of operation of the Reactor Makeup Control System provides blended boric acid solution, preset to match the boron concentration in the RCS.

Automatic makeup compensates for minor leakage of reactor coolant without causing significant changes in the reactor coolant boron concentration.

Under normal plant operating conditions, the mode selection switch is set in the "automatic makeup" position. This switch position establishes a preset control signal to the total makeup flow controller, and establishes positions for the makeup stop valves for automatic makeup. The boric acid flow controller is set to blend to the same concentration of borated water as contained in the RCS. A preset low level signal from the volume control tank level controller causes the automatic makeup control action to start a reactor makeup water pump, start a boric acid transfer pump, open the makeup stop valve to the charging pump suction, and position the boric acid flow control valve and the reactor makeup water flow control valve. The flow controllers then blend the makeup stream according to the preset concentration. Makeup addition to the charging pump suction header causes the water level in the volume control tank to rise. At a preset high level point, the makeup is stopped. This operation may be terminated manually at any time.

If the automatic makeup fails, or is not aligned for operation, and the tank level continues to decrease, a low level alarm is actuated. Manual action may correct the situation or, if the level continues to decrease, an emergency low level signal from both channels opens the stop valves in the refueling water supply line to the charging pumps, and closes the stop valves in the volume control tank outlet line.

(b) <u>Dilution</u>

The "dilute" mode of operation permits the addition of the preselected quantity of reactor makeup water at a preselected flow rate to the RCS. The operator sets the mode selector switch to "dilute," the total makeup flow controller setpoint to the desired quantity, and initiates system start. This opens the reactor makeup water flow control valve, opens the makeup stop valve to the volume control tank inlet, and starts a reactor makeup water pump. Excessive rise of the volume control tank water level is prevented by automatic actuation (by the tank level controller) of a three-way diversion valve which routes the reactor coolant letdown flow to the primary drain tank. When the preset quantity of water has been added, the batch integrator causes makeup to stop. Also, the operation may be terminated manually at any time.

Dilution can also be accomplished by operating the Boron Thermal Regeneration System in the boron storage mode.

(c) Alternate Dilution

The "alternate dilute" mode of operation is similar to the dilute mode, except that a portion of the dilution water flows directly to the charging pump suction, and a portion flows into the volume control tank via the spray nozzle and then flows to the charging pump suction. This decreases the delay in diluting the RCS caused by directing dilution water to the volume control tank.

(d) Boration

The "borate" mode of operation permits the addition of a preselected quantity of concentrated boric acid solution at a preselected flow rate to the RCS. The operator sets the mode selection switch to "borate," the concentrated boric acid flow controller setpoint to the desired flow rate, the concentrated boric acid batch integrator to the desired quantity, and initiates system start. This opens the makeup stop valve to the charging pumps suction, positions the boric acid flow control valve, and starts the selected boric acid transfer pump, which delivers a 4-weight percent boric acid solution to the charging pumps suction header. The total quantity added in most cases is so small that it has only a minor effect on the volume control tank level. When the preset quantity of concentrated boric acid solution is added, the batch integrator causes makeup to stop. Also, the operation may be terminated manually at any time.

Normal boration can also be accomplished, using the emergency boration path, by opening CS-V426 and starting a boric acid pump.

Boration can also be accomplished by operating the Boron Thermal Regeneration System in the boron release mode.

(e) Manual

The "manual" mode of operation permits the addition of a preselected quantity and blend of boric acid solution to the refueling water storage tank, to the primary drain tank, to the spent fuel pit, or to some other location via a temporary connection. While in the manual mode of operation, automatic makeup to the RCS is precluded. The discharge flow path must be prepared by opening manual valves in the desired path.

The operator sets the mode selector switch to "manual," the boric acid and total makeup flow controllers to the desired flow rates, the boric acid and total makeup batch integrators to the desired quantities, and actuates the makeup start switch.

The start switch actuates the boric acid flow control valve and the reactor makeup water flow control valve and starts the preselected reactor makeup water pump and boric acid transfer pump.

When the preset quantities of boric acid and reactor makeup water have been added, the batch integrators cause makeup to stop. This operation may be stopped manually by actuating the makeup stop switch.

If either batch integrator is satisfied before the other has recorded its required total, the pump and valve associated with the integrator which has been satisfied will terminate flow. The flow controlled by the other integrator will continue until that integrator is satisfied. In the manual mode, the boric acid flow is terminated first, to prevent piping systems from remaining filled with 4 percent boric acid solution.

The quantities of boric acid and reactor makeup water injected are totalized by the batch counters, and the flow rates are recorded on strip recorders. Deviation alarms sound for both boric acid and reactor makeup water if flow rates deviate from setpoints.

4. <u>Letdown Degasifier Operation</u>

The letdown degasifier may be operated during any mode of CVCS operation to process the letdown fluid. Operation of the degasifier is as follows:

(a) <u>Startup</u>

The system is slowly warmed up and operated on re-circulation until the liquid is thoroughly degassified. Then the influent and effluents may be realigned to process letdown flow.

The system must be purged with nitrogen prior to processing aerated liquids to the plant vent.

To avoid returning water to the RCS with a different boron concentration, the degasifier discharge is directed to the boron recovery system cesium removal ion exchanger (Subsection 9.3.5) for a sufficient time to insure that the degasifier effluent is representative of the RCS liquid.

(b) Normal Operation/Hot Standby

The letdown degasifier will automatically adjust all system operating parameters for all flow conditions from the 120 gpm maximum to no-flow or hot-standby.

(c) Shutdown

The system is transferred to re-circulation mode and allowed to slowly cool down.

The system must be purged with nitrogen prior to performing any maintenance on the system.

Although the degasifier is normally shut down per procedure, nonnuclear-safety pressure instrumentation is provided, for the vessel, to isolated inlet flowpaths on abnormally high pressure. Nonnuclear-safety flow instrumentation is provided on relief valve discharge piping as a backup to the pressure instrumentation. Relief valve discharge piping is routed to the release recovery quench tank which contains 15 ft^3 of available collection volume.

9.3.4.3 Safety Evaluation

The classification of structures, components and systems is presented in Section 3.2. A further discussion on seismic design categories is given in Section 3.7. Conformance with NRC General Design Criteria for the plant systems, components and structures important to safety is discussed in Section 3.1. Also, Section 1.8 provides a discussion on applicable regulatory guides.

a. Reactivity Control

Any time that the plant is at power the quantity of boric acid retained and ready for injection always exceeds that quantity required for normal cold shutdown immediately following refueling assuming that the control assembly of greatest worth is in its fully withdrawn position. This quantity always exceeds the quantity of boric acid required to bring the reactor to hot shutdown and to compensate for subsequent xenon decay. An adequate quantity of boric acid is also available in the refueling water storage tank to achieve cold shutdown.

When the reactor is subcritical (i.e., during cold or hot shutdown, refueling and approach to criticality), the neutron source multiplication is continuously monitored and indicated. Any appreciable increase in the neutron source multiplication, including that caused by the maximum physical boron dilution rate, is slow enough to give ample time to start a corrective action to prevent the core from becoming critical (the boron dilution accident is discussed in Subsection 15.4.6).

Two separate and independent flow paths are available for reactor coolant boration, i.e., the charging line and the reactor coolant pump seal injection line. A single failure does not result in the inability to borate the RCS. A third path exists via the cold leg injection line when the charging pump is aligned to the refueling water storage tank. This path may be used if the normal charging header is removed from service.

As backup to the normal boric acid supply, the operator can align the refueling water storage tank outlet to the suction of the charging pumps.

Since inoperability of a single component does not impair ability to meet boron injection requirements, plant operating procedures allow components to be temporarily out of service for repairs. However, with an inoperable component, the ability to tolerate additional component failure is limited. Therefore, the Technical Specifications require immediate action to effect repairs of an inoperable component, restrict permissible repair time, and require hydrogen as a cover gas on tankage collecting reactor coolant and provides surge volume for transient operation.

c. The reactor coolant vent header is designed to route potentially radioactive trapped gases form the Reactor Coolant System during fill and vent operations to a suitable filter prior to discharge.

d. The aerated and hydrogenated vent headers are designed to accept the maximum surge flow from all components simultaneously.

There is no cross-connection between the aerated and hydrogenated vent headers, except for their common discharge at the Primary Auxiliary Building normal ventilation cleanup exhaust unit.

9.3.6.2 System Description

a. Aerated Vent Header

The aerated vent header, Figure 9.3-41, receives vent gas that is predominantly air plus radioactive contaminants from various components in the Boron Recovery System (Subsection 9.3.5), the Liquid Waste System (Section 1.2), the Waste Solidification System (Section 11.4), the Steam Generator Blowdown System (Subsection 10.4.8), the Equipment and Floor Drainage System (Subsection 9.3.3), and the letdown degasifier during an oxygenated letdown sequence. The gas is then filtered and discharged to the atmosphere via the PAB normal ventilation cleanup exhaust unit.

b. Hydrogenated Vent Header

The hydrogenated vent header, Figure 9.3-41, collects radioactive contaminated hydrogen gas from the reactor coolant drain tank (RCDT), chemical volume control tank (CVCT), pressurizer relief tank (PRT) sample vessel, CVCT sample vessel, primary drain tank (PDT), primary drain tank degasifier and the letdown degasifier. Additionally, dependent on gaseous activity, the pressurizer may be purged to the hydrogenated vent header in preparation for outages. The collected gas is then processed through the Radioactive Gaseous Waste System (RGWS). See Section 11.3. After processing by the RGWS, the hydrogenated gas is either recycled to the vent system to act as a cover gas, returned directly to the Reactor Coolant System via the volume control tank, or directed to the Primary Auxiliary Building (PAB) exhaust unit via the vent header. The safety valve surge tank (SVST) provides additional header capacity and reduces the magnitude of pressure fluctuations within the header. Design requirements for the SVST are given in Table 9.3-10. A pressure regulating valve maintains a constant pressure of 2 psig in the influent line of the Radioactive Gaseous Waste System (RGWS) that serves to isolate the RGWS influent line from hydrogenated vent header pressure surges.

c. Reactor Coolant Vent Header

The reactor coolant vent header, Figure 9.3-41, provides for the evacuation of the Reactor Coolant System during filling operations. Additionally, dependent on gaseous activity, the pressurizer may be purged to the hydrogenated vent header via the reactor coolant vent header in preparation for outages. During normal plant operations, the reactor coolant vent header is isolated from the hydrogenated vent header by a locked-closed valve.

Prior to the Reactor Coolant System filling operation, the hydrogenated vent header is isolated from the reactor coolant vent header, except for a path to the PAB exhaust unit which is purged with nitrogen. The reactor coolant vent header is then connected to the components and piping of the Reactor Coolant System by the insertion of a spool piece between the vent line. A separator/silencer separates any entrained liquid which is then drained to containment sump "A."

Prior to entering an outage and the opening of the RCS, the pressurizer gas space may be purged to the PAB exhaust unit or the hydrogenated vent header dependent on gaseous activity. When routed to the hydrogenated vent header, the reactor coolant vent header is aligned to the pressurizer via the vent spool and purged with nitrogen. Following completion of the pressurizer purge the reactor coolant vent header is isolated from the hydrogenated vent header.

An evacuation pump is used during filling operations to direct the air from the reactor coolant vent header to the hydrogenated vent header where it is filtered and discharged to the atmosphere. Design requirements for the evacuation pump are given in Table 9.3-10.

An alternate means for evacuating the RCS during filling operations is provided by a portable evacuation skid. This skid uses an air-driven eductor that is connected to the reactor vessel head vent and the pressurizer vent. The portable evacuation skid does not utilize the hydrogenated vent header. Discharge from the portable evacuation skid is directed to the atmosphere via a HEPA filter.

9.3.6.3 Safety Evaluation

To eliminate the possibility of obtaining a flammable mixture of hydrogen and oxygen, the hydrogenated vent header is thoroughly purged with nitrogen prior to startup and immediately following its shutdown.

The aerated vent header may contain trace amounts of hydrogen during the administratively controlled oxygenated letdown sequence. However, due to continuous header flow, hydrogen accumulation will not occur.

The design flow transient in the hydrogenated vent header occurs during the filling of one primary drain tank (PDT) at a rate of 120 gpm over a period of ten minutes. With one PDT full, and the other PDT containing the most limiting level of fluid, the header pressure increases to a level which is less than the design pressure (15 psig).

The section of the hydrogenated vent header which penetrates the containment wall and its associated containment isolation valves are designated Safety Class 2, seismic Category I. All other piping and components in the Equipment Vent System are designated as Nonnuclear Safety Class.

The hydrogenated vent header is protected against overpressurization by a pilot-operated relief valve which directs the gas flow through HEPA filters and charcoal filters before discharging it to atmosphere via the plant vent stack. (The PAB exhaust unit is discussed in detail in Subsection 9.4.3.)

If the PAB exhaust unit is not available, the hydrogenated vent header is protected against overpressurization by an ASME code relief valve set at the system design pressure. This relief valve discharges to atmosphere through a separate particulate filter and charcoal filter. The pilot-operated relief valve is set at a lower pressure than the ASME code relief valve since it is the preferenced relief path.

9.3.6.4 Testing and Inspection Requirements

Periodic testing of the Equipment Vent System is not necessary as the system is in normal operation. In the hydrogenated vent header, the containment isolation valves and the pipe line that penetrates the Containment Building are tested in accordance with the procedures of Subsections 6.2.4.4 and 6.2.6.

9.3.6.5 Instrumentation Requirements

Pressure indicators are provided in the three vent headers of the Equipment Vent System.

Pressure indication and a high pressure alarm are provided for the Hydrogenated Vent Gas header. These signals are displayed in the main control room by the Main Plant Computer System (MPCS).

The containment isolation valves in the hydrogenated vent header are automatically closed by a "T" signal in the event of containment isolation, and do not open automatically when the "T" signal is reset.

The pilot-operated relief valve in the hydrogenated vent header directs radioactive gases to the PAB exhaust unit in the event of high pressure in the vent header. To inhibit the opening of this relief valve, an alarm at the MCB (at a setting lower than that of the relief valve) alerts the operator who then initiates corrective action to prevent pressure buildup in the header. A sight flow glass is used in each reactor coolant system vent line.

TABLE 9.3-1
(Sheet 3 of 8)

SAMPLES FROM SAMPLING SYSTEM

System	Sample Source	Analysis	Type Sample	Purpose	Application
Reactor Coolant (Cont)	Pressurizer Relief Tank	Oxygen Concentration	LP-G	Detect explosive mixture when oxygen and hydrogen could be present	Guide operation to avoid explosion hazard
	Pressurizer Relief Tank	Dissolved Fission Gases	LP-G	Detect accumulation of gross fission gas activity	Guide to venting
Residual Heat Removal	Residual Heat Removal Loop	Boron Concentration	A-L	Determine variance from reactor coolant concentration	Avoid undesirable reactivity insertion
Chemical and Volume Control	Downstream of Demineralizers	Boron Concentration	A-L	Detect deviation from specified value	Monitor concentration
	Downstream of Demineralizers	pH Measurement	A-L	Detect deviation from specified value	Guide operation to assure effective corrosion control
	Volume Control Tank Gas	Hydrogen Concentration	LP-G	Detect explosive mixture when oxygen and hydrogen could be present	Guide operation to avoid explosion hazard
	Volume Control Tank Gas	Oxygen Concentration	LP-G	Detect explosive mixture when oxygen and hydrogen could be present	Guide operation to avoid explosion hazard

TABLE 9.3-1
(Sheet 4 of 8)

SAMPLES FROM SAMPLING SYSTEM

System	Sample Source	Analysis	Type Sample	Purpose	Application
Chemical and Volume Control (Cont)	Upstream of Demineralizers	Halides	A-L	Determine Decontamination Factor	Resin performance
	Downstream of Demineralizers	Halides	A-L	Determine Decontamination Factor	Resin performance
	Volume Control Tank	Dissolved Fission Gases	LP-G	Detect accumulation of gross fission gas activity	Guide to venting
	Demineralizer Outlet	Gamma Activity	A-L	Detect concentration	Evaluate resin bed performance
	Upstream of Demineralizers	Gamma Activity	A-L	Determine I-131, I-133 activity	Indicates fuel element failure
	Downstream of Degasifier	Dissolved Fission Gases	A-L	Detect concentration above the specified limit	Guide to operation of degassifier
Steam Generator	Sampling and analysis based on EPRI PWR Secondary Water Chemistry Guidelines and Primary to Secondary Leak Rate Guidelines.				

TABLE 9.3-1
(Sheet 5 of 8)

SAMPLES FROM SAMPLING SYSTEM

System	Sample Source	Analysis	Type Sample	Purpose	Application
Steam Generator (Cont)	Sampling and analysis are based on EPRI PWR Secondary Water Chemistry Guidelines.				
Condensate					

TABLE 9.3-1
(Sheet 6 of 8)

SAMPLES FROM SAMPLING SYSTEM

System	Sample Source	Analysis	Type Sample	Purpose	Application
Feedwater	Sampling and analysis are based on EPRI PWR Secondary Water Chemistry Guidelines.				
Main Steam					
B. Post-Accident Sampling:					
Reactor Coolant	Reactor Coolant Loops	Boron Concentration	A-L	Verify shutdown margin	Maintain reactor core in noncritical condition when Reactor Coolant System is pressurized

TABLE 9.3-1
(Sheet 7 of 8)

SAMPLES FROM SAMPLING SYSTEM

System	Sample Source	Analysis	Type Sample	Purpose	Application
Emergency Core Cooling	Containment Recirculation Sumps	Boron Concentration	A-L	Verify shutdown margin	Maintain reactor core in noncritical condition when Reactor Coolant System is depressurized by a LOCA
Reactor Coolant					
	Reactor Coolant Loops	Gamma Activity	A-L	Determine gamma spectrum to estimate extent of core damage	Establish remedial action (if any) to be taken
	Reactor Coolant Loops	Chloride Concentration	A-L	Estimate coolant's corrosive tendency	Guide for reactor restart
	Reactor Coolant Loops	pH Measurement	A-L	Detect deviation from specified value	Guide for reactor restart
Emergency Core Cooling	Containment Recirculation Sumps	Gamma Activity	A-L	Determine gamma spectrum to estimate extent of core damage	Establish remedial action (if any) to be taken

TABLE 9.3-1
(Sheet 8 of 8)

SAMPLES FROM SAMPLING SYSTEM

System	Sample Source	Analysis	Type Sample	Purpose	Application
Emergency Core Cooling	Containment Recirculation Sumps	Gamma Activity	A-L	Determine gamma spectrum to estimate extent of core damage	Establish remedial action (if any) to be taken
Containment	Containment Atmosphere	Hydrogen Concentration	P-G	Estimate extent of core damage and potential for stoichiometric mixture with oxygen	Establish remedial action (if any) to be taken in regard to core, and determine if purging of containment is appropriate
Containment	Containment Atmosphere	Gaseous Radionuclides Concentration	P-G	Determine gamma spectrum to quantify activity levels of constituents	Establish remedial action (if any) to be taken in regard to estimate of core damage, and determine rate and duration for any purging of containment
Floor and Equipment Drain	ECCS Pump Room Sumps	Gamma Activity	A-L	Determine gamma spectrum	Guide to source(s) of leakage
	ECCS Pump Room Sumps	Suspended Solids Activity	A-L	Determine isotopic composition of corrosion products	Guide to source(s) of leakage

TABLE 9.3-2
(Sheet 1 of 4)

EQUIPMENT DATA - REACTOR COOLANT, STEAM GENERATOR AND AUXILIARY SYSTEMS SAMPLING SUBSYSTEMS

1. Sample Heat Exchangers

Quantity	
Pressurizer	4
Steam Generator	4
Safety Class	NNS
Seismic Category	Nonseismic
Design Code	ASME VIII, Div. I
Design Heat Load	
Pressurizer (1 of 2 in series), Btu/hr	$3.7x10^5$
Pressurizer (2 of 2 in series), Btu/hr	$0.3x10^5$
Steam Generator, Btu/hr	$2.0x10^5$
Shell Side	
PCCW Flow, gpm	8
Temperature In, °F	85
Temperature Out	
Pressurizer (1 of 2 in series), °F	177
Pressurizer (2 of 2 in series), °F	92
Steam Generator, °F	129
Design Temperature, °F	350
Design Pressure, psi	150
Pressure Drop	
Pressurizer (1 of 2 in series), psi	7
Pressurizer (2 of 2 in series), psi	8
Steam Generator, psi	7.3
Tube Side	
Material	316 SS
Diameter, in.	3/8
Sample Flow, gpm	0.75
Temperature In	
Pressurizer (1 of 2 in series), °F	650
Pressurizer (2 of 2 in series), °F	167
Steam Generator, °F	558
Temperature - Out	
Pressurizer (1 of 2 in series), °F	167
Pressurizer (2 of 2 in series), °F	95
Steam Generator, °F	109
Design Temperature, °F	650
Design Pressure, psig	2485
Pressure Drop	
Pressurizer (1 of 2), psi	13.1
Pressurizer (2 of 2), psi	15.3
Steam Generator, psi	13.5

TABLE 9.3-2
(Sheet 2 of 4)

EQUIPMENT DATA - REACTOR COOLANT, STEAM GENERATOR AND AUXILIARY SYSTEMS SAMPLING SUBSYSTEMS

2. Capillary Tubes

Pressurizer Liquid Sample Line	
Tube O.D., in.	0.25
Tube Wall Thickness, in.	0.065
Pressurizer Steam Space Sample Line	
Tube O.D., in.	0.25
Tube Wall Thickness, in.	0.065
Material	Austenitic Stainless Steel
Safety Class	2
Seismic Category	I

3. Valves, Piping and Tubing

Reactor Coolant Sample Lines	
Design Pressure, psig	2485
Design Temperature, °F	680
O.D., in.	0.375
Wall Thickness, in.	0.065
Steam Generator Blowdown Sample Lines	
Design Pressure, psig	1185
Design Temperature, °F	600
O.D., in.	0.375
Wall Thickness, in.	0.065
Chemical and Volume Control Demineralizers Sample Lines	
Design Pressure, psig	240
Design Temperature, °F	150
O.D., in.	0.375
Wall Thickness, in.	0.065
Volume Control Tank Gas Space	
Design Pressure, psig	75
Design Temperature, °F	150
O.D., in.	0.375
Wall Thickness, in.	0.065
Residual Heat Removal Sample Line	
Design Pressure, psig	600
Design Temperature, °F	400
O.D., in.	0.375
Wall Thickness, in.	0.065

TABLE 9.3-2
(Sheet 3 of 4)

EQUIPMENT DATA - REACTOR COOLANT, STEAM GENERATOR AND AUXILIARY SYSTEMS SAMPLING SUBSYSTEMS

Material	Austenitic Stainless Steel
Design Codes	ANSI B31.1.0, except inside containment and containment isolation which are designed to ASME III
Safety Class	2 and NNS
Seismic Category	Non-Seismic except inside containment and containment isolation which are seismic Category I

4. Post-Accident Sampling

Sample Pumps

Design Flow	2.0 gpm @ 300′ TDH
Design Temperature	180°F (425°F environmental)
Material	316 SS
Design Radiation Exposure	$1x10^8$ rads
Safety Class	NNS
Seismic Category	Non-Seismic

Flush Tank

Volume, ml	9,600
Design Pressure, psig	2,471
Design Temperature, °F	650
Material	Austenitic Stainless Steel
Design Code	ANSI B31.1.0
Safety Class	NNS
Seismic Category	Non-Seismic

Sample Cask

Size of Cavity, inches	5 I.D. x 51/2 lg.
Wall and End Thickness, inches	3
Shielding Material	Lead

Sample Vessel

Volume, ml	75
Design Pressure, psig	2,335
Design Temperatures °F	635
Material	Austenitic Stainless Steel
Design Code	ASME VIII, Div. 1
Safety Class	NNS

TABLE 9.3-2
(Sheet 4 of 4)

EQUIPMENT DATA - REACTOR COOLANT, STEAM GENERATOR AND AUXILIARY SYSTEMS SAMPLING SUBSYSTEMS

Seismic Category	Non-Seismic

Cylinders

1st Expansion Cylinder Volume, ml	300
2nd Expansion Cylinder Volume, ml	1,000
Mixing Cylinder Volume, ml	1,000
Design Pressure, psig	2,335 and Full Vacuum
Design Temperature, °F	635
Material	Austenitic Stainless Steel
Design Code	ASME VIII, Div. 1
Safety Class	NNS
Seismic Category	Non-Seismic

Valves, Piping, and Tubing

Sample Lines	
Design Pressure, psig	2,335
Design Temperature, °F	635
O.D., inches	0.25
Wall Thickness, inches	0.065 and 0.083
Demineralized Water Lines	
Design Pressure, psig	60 and Full Vacuum
Design Temperature, °F	95
O.D., inches	0.375
Wall Thickness, inches	0.049 and 0.065
Bath Water Lines	
Design Pressure, psig	0 (Atmosphere)
Design Temperature	40 - 95
O.D., inches	1/2
Wall Thickness, inches	0,035
Material	Austenitic Stainless Steel
Design Code	ANSI B31.1.0
Safety Class	NNS
Seismic Category	Non-Seismic

TABLE 9.3-3
(Sheet 1 of 2)

PLANT LEAKAGE SOURCES

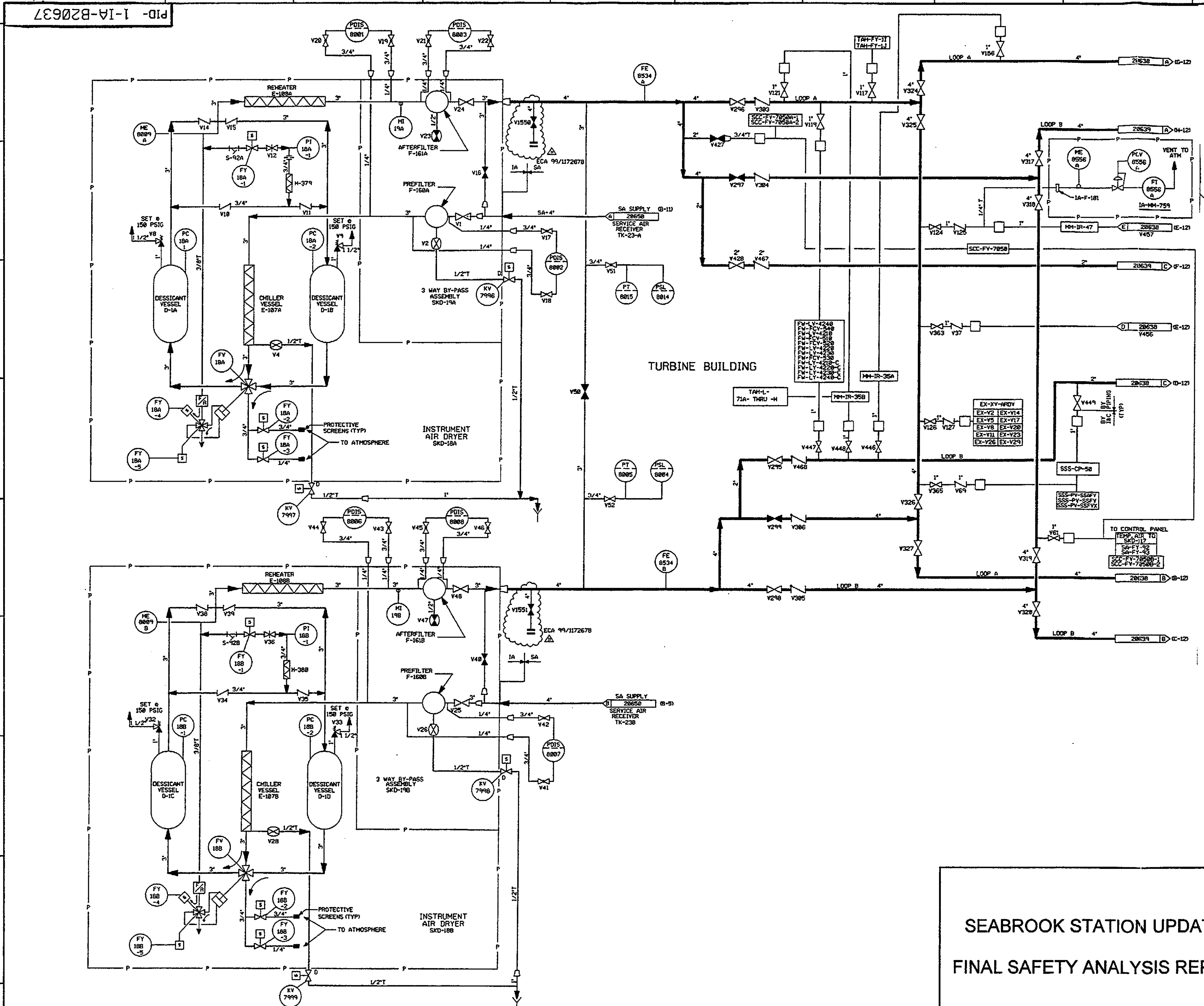
a. Containment

1. Sump A

Source	Normal Leak Rate
RC Pump 1A, #3 Seal	3.5 gpd
RC Pump 1B, #3 Seal	3.5 gpd
RC Pump 1C, #3 Seal	3.5 gpd
RC Pump 1D, #3 Seal	3.5 gpd
Six Containment Cooler Drains	Negligible
2. RCDT	
RC Pump 1A, #2 Seal	3.0 gph
RC Pump 1B, #2 Seal	3.0 gph
RC Pump 1C, #2 Seal	3.0 gph
RC Pump 1D, #2 Seal	3.0 gph
b. Primary Auxiliary Building	
Sample Sink	900 gpd
Containment Enclosure Cooling Units (2)	1 gph, each
c. RHR/CBS Equipment Vaults to Sumps A and B	
All Sources	Negligible
d. Fuel Storage Building	
Spent Fuel Cask Washdown*	20 gpm
e. Waste Processing Building	
Sample Sink (Elev. (-)3'-0")	100 gpd

* Not actually leakage, but resulting flow during cask washdown.

REV. 07



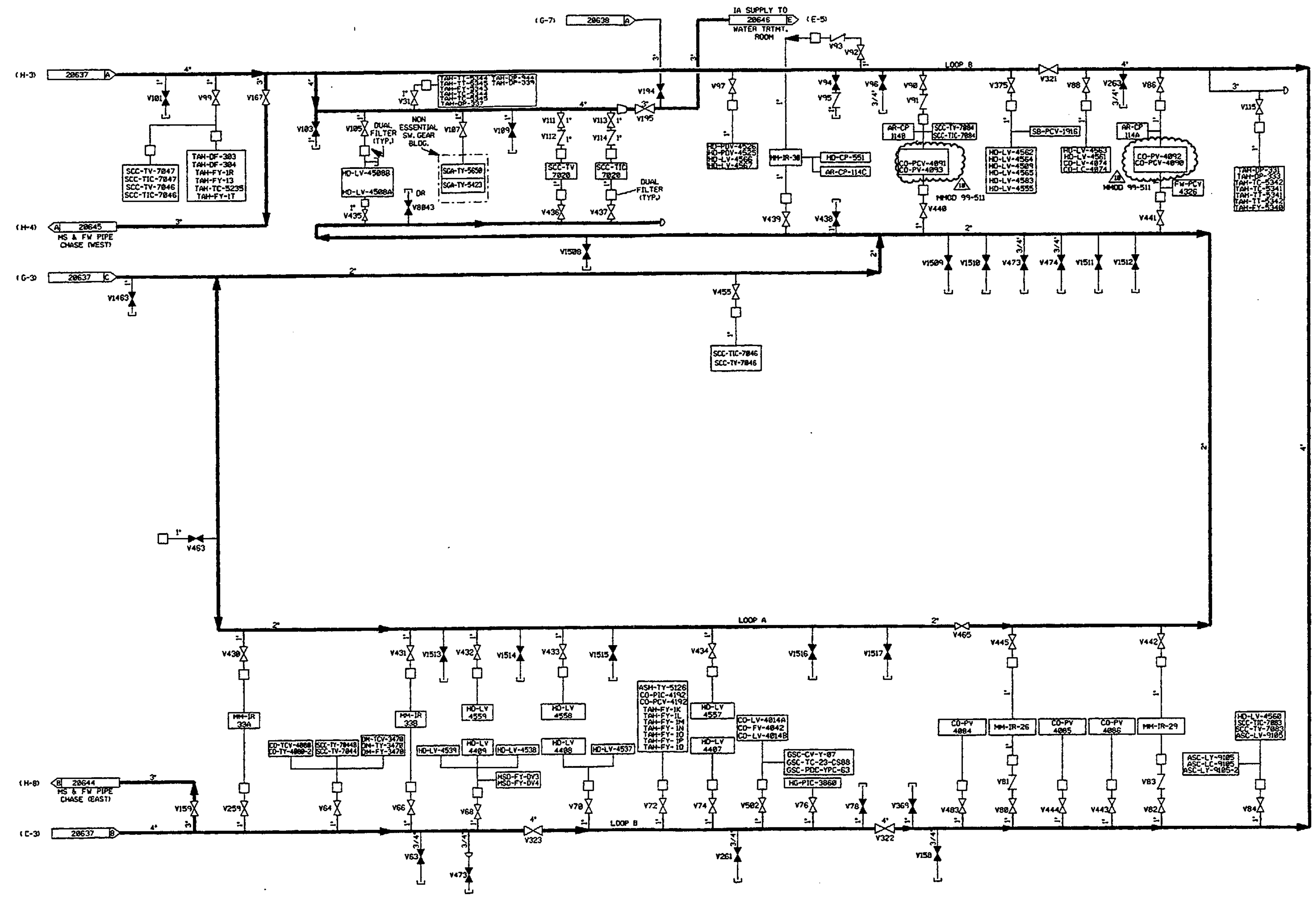
FOR P & ID REFERENCE DRAWING SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P & ID-LEGEND 1 AND P & ID-LEGEND 2

NOTE:
1. ALL LINES, VALVES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX IA, UNLESS NOTED OTHERWISE.
2. WORK THIS DRAWING WITH DRAWINGS 20636 AND 20638 THRU 20646.
3. ☐ DENOTES DUAL AIR FILTER.
4. ALL LINES, VALVES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS.
5. P&ID SHOWN FOR INSTR. AIR DRYERS 18A & B DEPICTS AIR SIDE ONLY. FOR REFRIGERATION SIDE OF DRYERS REFER TO FP20420.
6. INSTRUMENTATION ON THIS DWG DOWNSTREAM OF THE PIPING ROOT VALVE CONNECTIONS HAS NOT BEEN FIELD VERIFIED; EXCEPT V447, V448, V446, V117, V156, V121, V119, & SUPPLY TO 1A-MM-759.
7. △ INDICATES REVISION LEVEL.
8. VALVE SYMBOL MAY NOT BE REPRESENTATIVE OF INSTALLED COMPONENT TYPE, REFER TO VALVE LIST.

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	INSTRUMENT AIR TURBINE BUILDING DETAIL
1-IA-B20637	FIGURE 9.3-2 SH 1

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

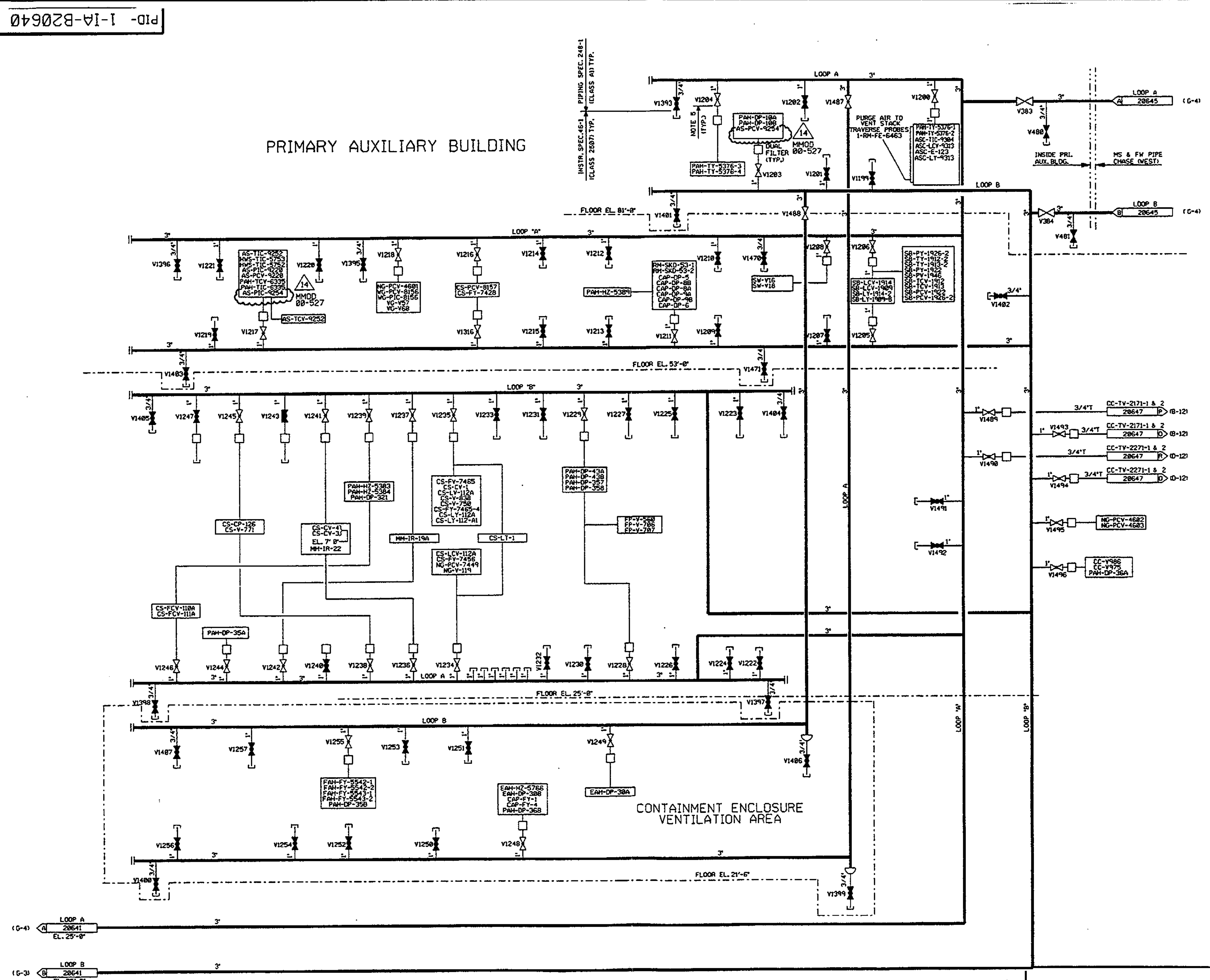


NOTES:

1. ALL PIPING, VALVES, EQUIPMENT, COMPONENTS, AND INSTRUMENTS HAVE SYSTEM PREFIX IA, UNLESS NOTED OTHERWISE.
2. WORK THIS DRAWING WITH DRAWINGS 20636 THRU 20638, & 20640 THRU 20646.
3. ☐ DENOTES DUAL AIR FILTER.
4. ALL PIPING, VALVES, EQUIPMENT, COMPONENTS, AND INSTRUMENTS ARE SAFETY CLASS NNS, UNLESS NOTED OTHERWISE.
5. DELETED
6. △ INDICATES REVISION LEVEL
7. VALVE SYMBOL MAY NOT BE REPRESENTATIVE OF INSTALLED COMPONENT TYPE. REFER TO VALVE LIST.

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	INSTRUMENT AIR TURBINE BUILDING DETAIL
1-IA-B20639	FIGURE 9.3-2 SH 3

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID-LEGEND 1 AND P&ID-LEGEND 2.

NOTES:

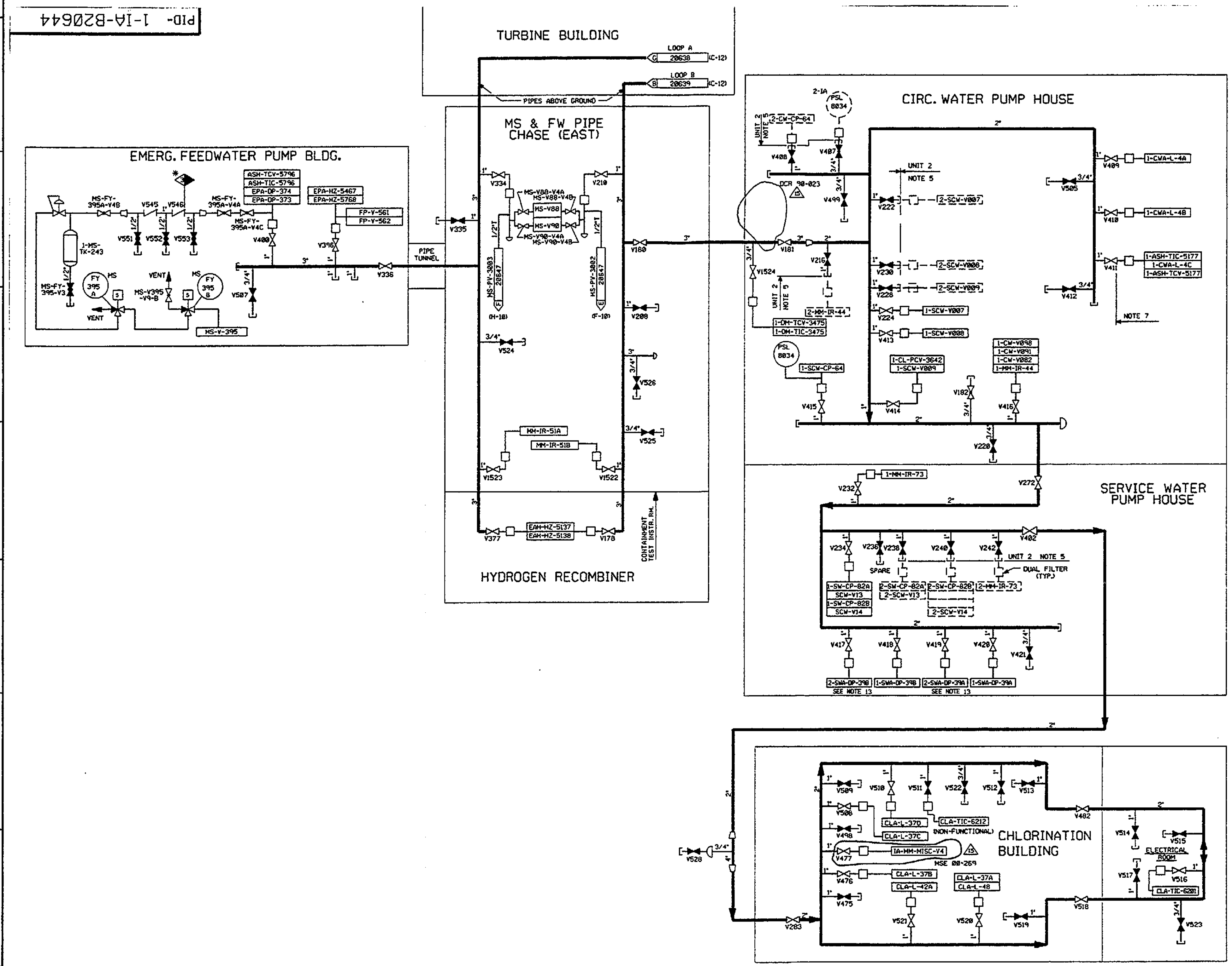
1. WORK THIS DRAWING WITH DRAWINGS 20636 THRU 20639 & 20641 THRU 20646.
2. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTS HAVE SYSTEM PREFIX IA. UNLESS NOTED OTHERWISE.
3. ☐ DENOTES DUAL AIR FILTER.
4. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTS ARE SAFETY CLASS NNS UNLESS NOTED OTHERWISE.
5. INSTRUMENTATION ON THIS DWG DOWNSTREAM OF PIPING ROOT VALVE CONNECTIONS HAS NOT BEEN VERIFIED.
6. △ INDICATES REVISION LEVEL.
7. DELETED
8. DELETED.
9. VALVE SYMBOL MAY NOT BE REPRESENTATIVE OF INSTALLED COMPONENT TYPE. REFER TO VALVE LIST.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	INSTRUMENT AIR PRIMARY AUX. BUILDING DETAIL
	1-IA-B20640 / FIGURE 9.3-3

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20636 THRU 20643, 20645, 20646 & 20647.
2. ALL LINES, VALVES, EQUIPMENT & INSTRUMENTS HAVE SYSTEM PREFIX IA, UNLESS NOTED OTHERWISE.
3. ☐ DENOTES DUAL AIR FILTER.
4. ALL PIPES, VALVES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS "NNS", UNLESS NOTED OTHERWISE.
5. UNIT 2 EQUIPMENT SHOWN IN PHANTOM HAS NOT BEEN INSTALLED. ASSOCIATED ROOT VALVES ARE CAPPED AND WILL BE USED FOR THIS FUTURE INSTALLATION.
6. △ INDICATES REVISION LEVEL.
7. DELETED
8. DELETED
9. DELETED
10. DELETED
11. * DENOTES ANS SAFETY CLASS 3, NOT ASME CODE CLASS 3.
12. INSTRUMENTATION ON THIS DRAWING DOWNSTREAM OF PIPING ROOT VALVE CONNECTIONS HAS NOT BEEN VERIFIED.
13. AIR SUPPLY MAINTAINED TO DAMPERS TO SUPPORT THE SEABROOK STATION COMPENSATORY VENTILATION PLAN C-S-1-61005.
14. VALVE SYMBOLS MAY NOT BE REPRESENTATIVE OF INSTALLED COMPONENT TYPE. REFER TO VALVE LIST.

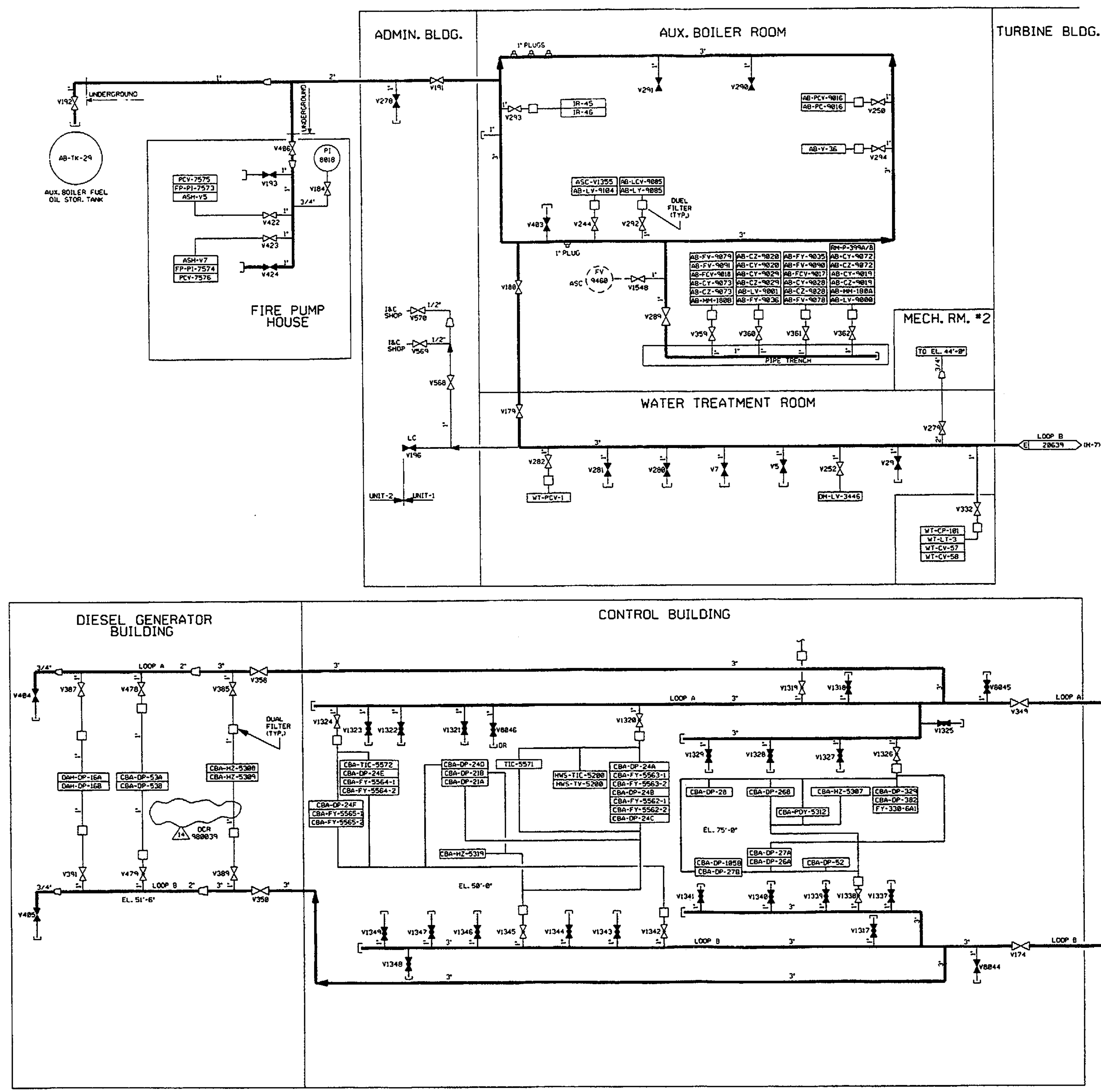
PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	INSTRUMENT AIR MISCELLANEOUS BUILDING DETAIL
	1-IA-B20644 / FIGURE 9.3-6 SH 1

PID- 1-IA-B20646

REV. 07



NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20636 THRU 20645.
2. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX IA, UNLESS NOTED OTHERWISE.
3. ☐ DENOTES DUAL AIR FILTER.
4. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS, UNLESS NOTED OTHERWISE.
5. INSTRUMENTATION ON THIS DWG DOWNSTREAM OF THE PIPING ROOT VALVE CONNECTION HAS NOT BEEN FIELD VERIFIED.
6. △ INDICATES REVISION LEVEL
7. VALVE SYMBOL MAY NOT BE REPRESENTATIVE OF INSTALLED COMPONENT TYPE. REFER TO VALVE LIST.

REF. DRAWING NO.	REV	TITLE
9763-M-500214	1	FIRE PUMP HOUSE, IA DISTR. P & ID.
9763-F-202109	9	MISC. BLDG. COMP. AIR HDRS. P & ID.
9763-C-500324	7	CONTROL BLDG. INSTR. AIR DISTRIB P & ID
9763-F-202105	11	COMP. AIR SYS. KEY PLAN P & ID.
9763-M-500326	6	DIESEL GEN. BLDG. IA P & ID.
9763-C-500330	9	ADMIN. & SERV. BLDG. AUX. BLR. & WTR TRT

SEABROOK STATION UPDATED

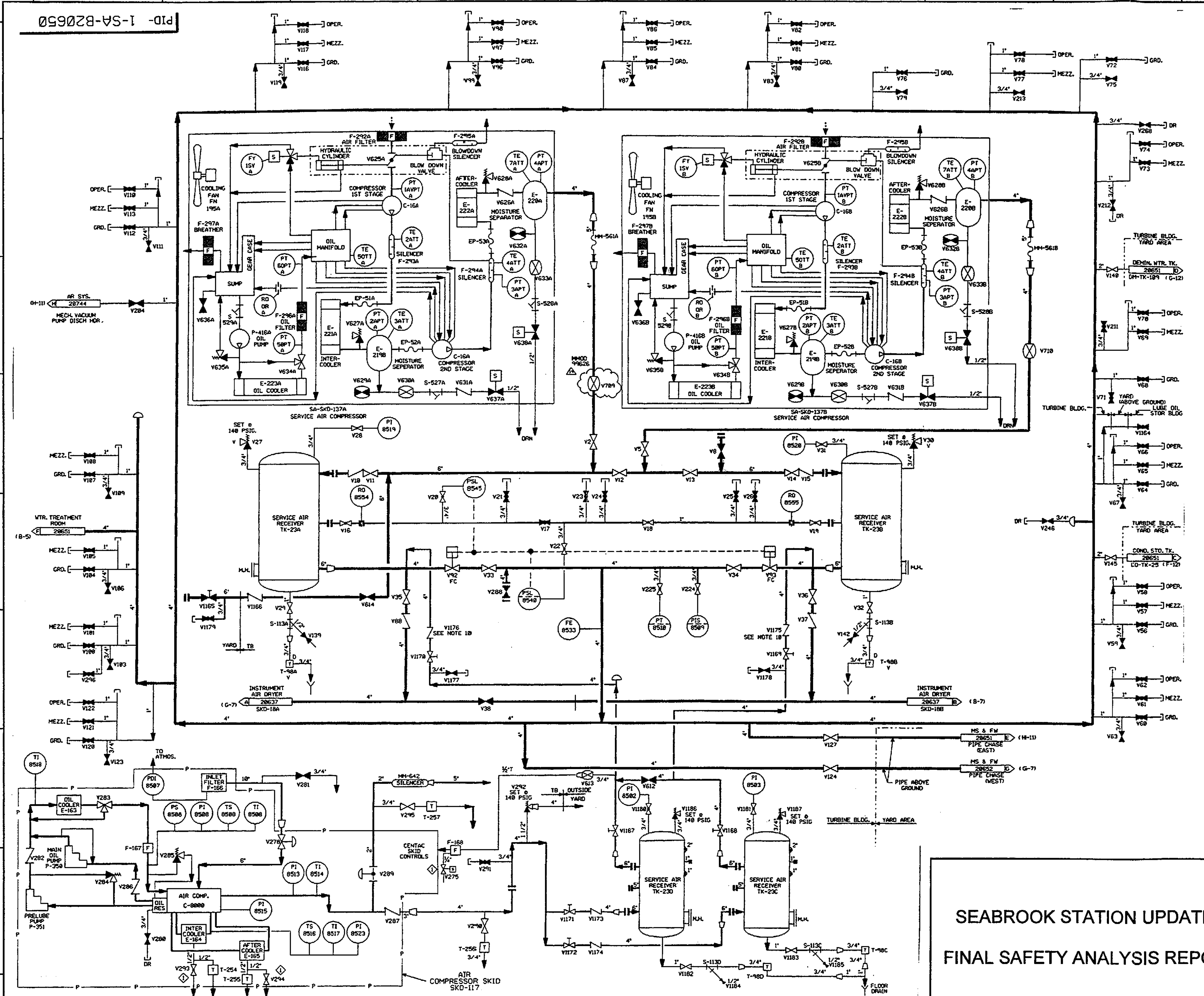
FINAL SAFETY ANALYSIS REPORT

INSTRUMENT AIR
MISCELLANEOUS BUILDINGS
DETAILS

1-IA-B20646

FIGURE 9.3-6 SH 3

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

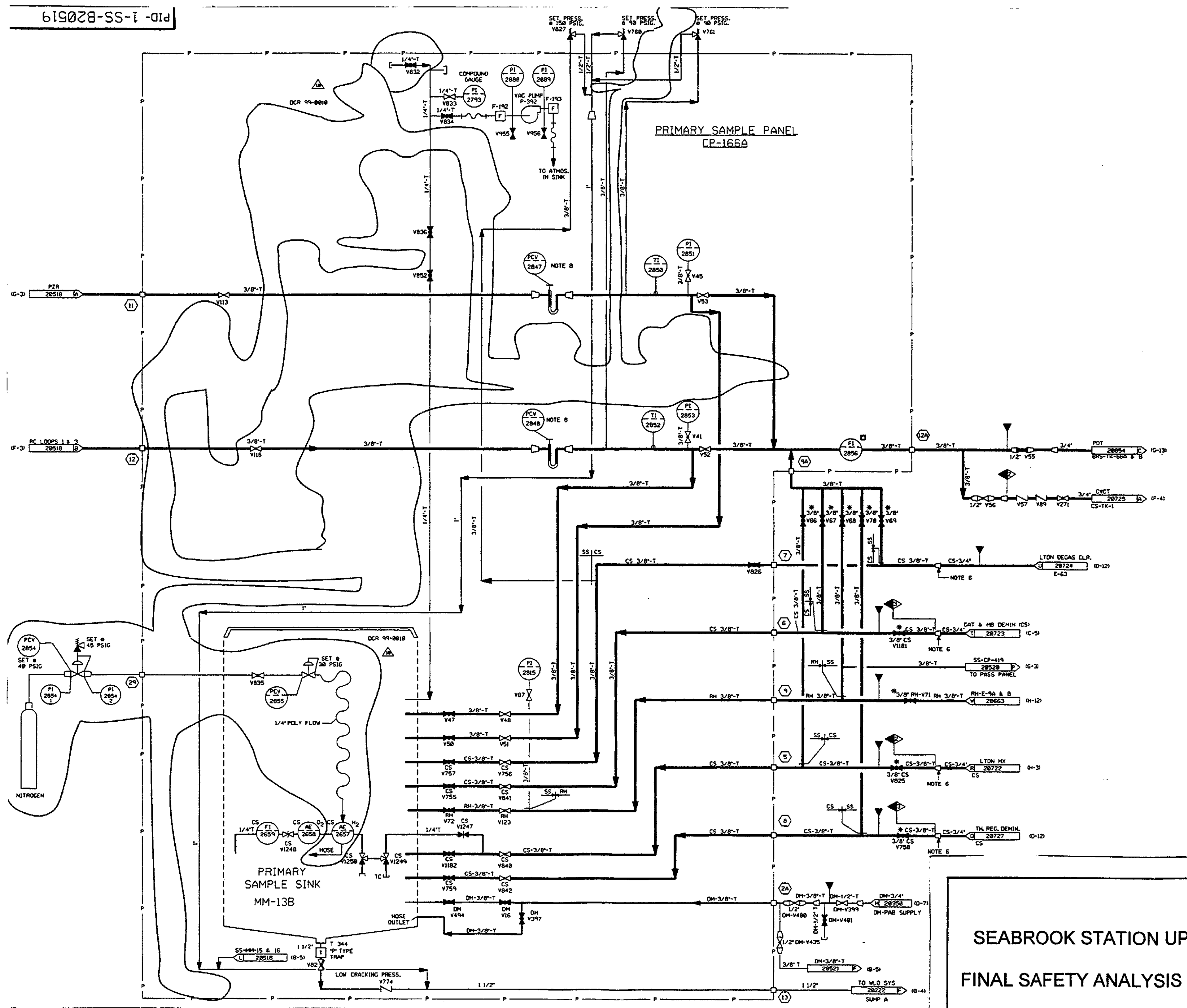
◇1 VALVES V275, V293 & V294 ARE NORMALLY CLOSED PENDING ENGINEERING DOCUMENTATION.

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20649, 20651, 20652 & 20653.
2. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX SA. UNLESS NOTED OTHERWISE.
3. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS UNLESS NOTED OTHERWISE.
4. INSTRUMENT REFERENCES:
   - (A) TO SCC-V126, FV-7060 (DWG. SCC-20078)
   - (B) TO SCC-V129, FV-7061 (DWG. SCC-20078)
   - (C) TO SCC-V132, FV-7062 (DWG. SCC-20078)
5. ALL PIPING RUNNING BETWEEN BUILDINGS OR TO OUTSIDE EQUIPMENT IS BELOW GROUND EXCEPT AS NOTED.
6. INDICATES REVISION LEVEL.
7. DELETED
8. PIPE CAPS OR QUICK DISCONNECTS MAY BE INSTALLED ON SERVICE AIR STATIONS AS DEEMED NECESSARY BY STATION STAFF.
9. ◇ INCOMPLETE ITEM
10. INTERNALS OF CHECK VALVES, SA-V1175 & 1176 HAVE BEEN REMOVED.
11. VALVE SYMBOL MAY NOT BE REPRESENTATIVE OF INSTALLED COMPONENT TYPE, REFER TO VALVE LIST.

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SERVICE AIR SYSTEM TURBINE BUILDING DETAIL	
	1-SA-B20650	FIGURE 9.3-8

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES :

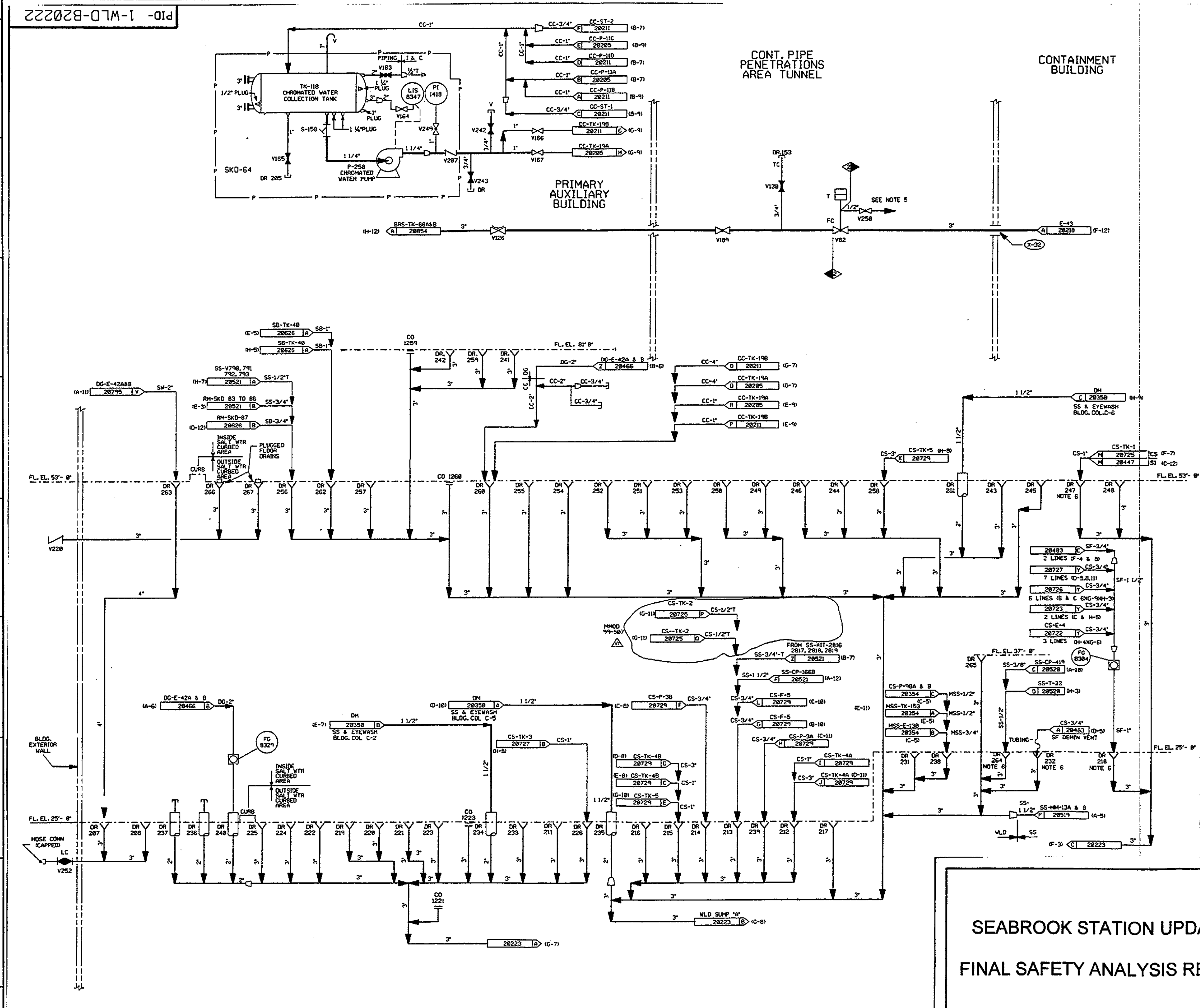
1. WORK THIS DRAWING WITH DRAWING 20516, 20518, 20520 THRU 20522.
2. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX "SS", UNLESS OTHERWISE NOTED.
3. ALL TUBING 3/8" T AND MAT'L 2500 UNLESS OTHERWISE NOTED.
4. DELETED
5. DELETED
6. THESE REDUCERS ARE TO BE AS CLOSE AS POSSIBLE TO ROOT VALVE.
7. ✱ THIS VALVE TO BE REACH ROD OPERATED FROM THE SAMPLE RM SIDE OF THE SAMPLE HX ROOM -SAMPLE WALL.
8. THIS EQUIPMENT HAS 1/4" TUBING CONNECTORS.
9. △ INDICATES REVISION LEVEL. DCR 99-0010 △3
10. DELETED.
11. ⬡ CONTINUATION CONNECTION. SEE FP-74082.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SAMPLE SYSTEM PRIMARY SAMPLE PANEL CP-166A
1-SS-B20519	FIGURE 9.3-12

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

DRAINS ON THIS DRAWING

207	219	233	243	253	263
208	220	234	244	254	264
211	221	235	245	255	265
212	222	236	246	256	266
213	223	237	247	257	267
214	224	238	248	258	
215	225	239	249	259	
216	226	240	250	260	
217	231	241	251	261	
218	232	242	252	262	

CLEANOUTS ON THIS DRAWING

1221
1223
1259
1260

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20216, 20218 THRU 20221, & 20223 THRU 20229.
2. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTATION HAVE SYSTEM PREFIX WLD UNLESS NOTED OTHERWISE.
3. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTATION ARE SAFETY CLASS NNS UNLESS NOTED OTHERWISE.
4. △ INDICATES REVISION LEVEL.
5. REFER TO DRAWING VSL-20774 FOR VALVE LEAKOFF.
6. THIS DRAIN HAS A GAS CONTAINMENT DEVICE ADDED PER MMOD 96-655.

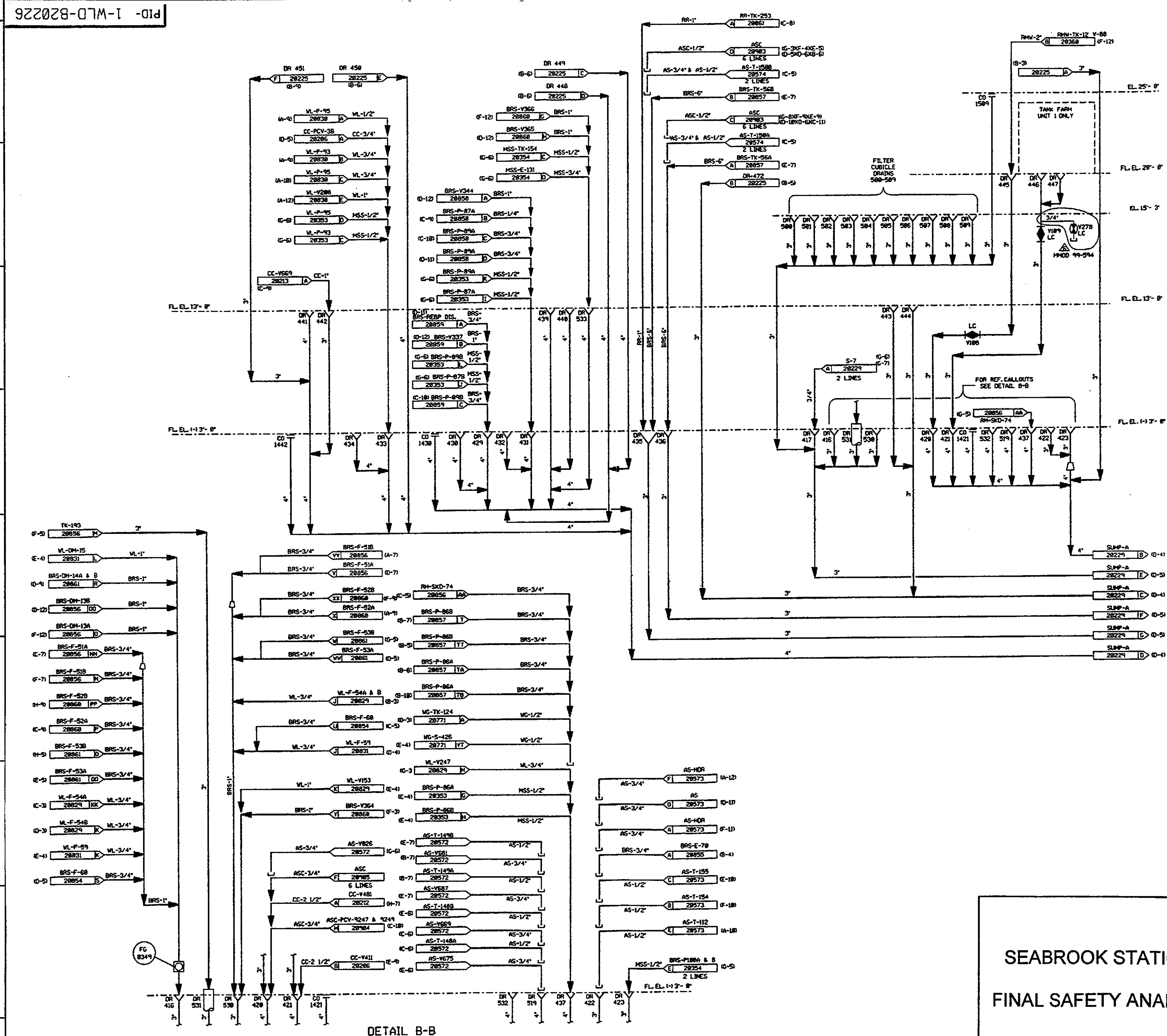
PORTIONS OF THIS DRAWING ARE **NUCLEAR SAFETY RELATED**

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	WASTE PROCESSING LIQUID DRAINS PRIMARY AUXILIARY BLDG. SHT. 1 OF 2	
	1-WLD-B20222	FIGURE 9.3-21 SH 1

10/13/00 REV. 17

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



DRAINS ON THIS DRAWING

416	431	440	500	508
417	432	441	501	509
420	433	442	502	519
421	434	443	503	530
422	435	444	504	531
423	436	445	505	533
429	437	446	506	532
430	439	447	507	

CLEANOUTS ON THIS DRAWING

1421
1430
1442
1509

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20216, 20218 THRU 20225, 20227 THRU 20229.
2. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTATION HAVE SYSTEM PREFIX WLD, UNLESS NOTED OTHERWISE.
3. ALL LINES, EQUIPMENT, COMPONENTS, AND INSTRUMENTS ARE SAFETY CLASS NNS, UNLESS NOTED OTHERWISE.
4. △ INDICATES REVISION LEVEL.

SEABROOK STATION UPDATED

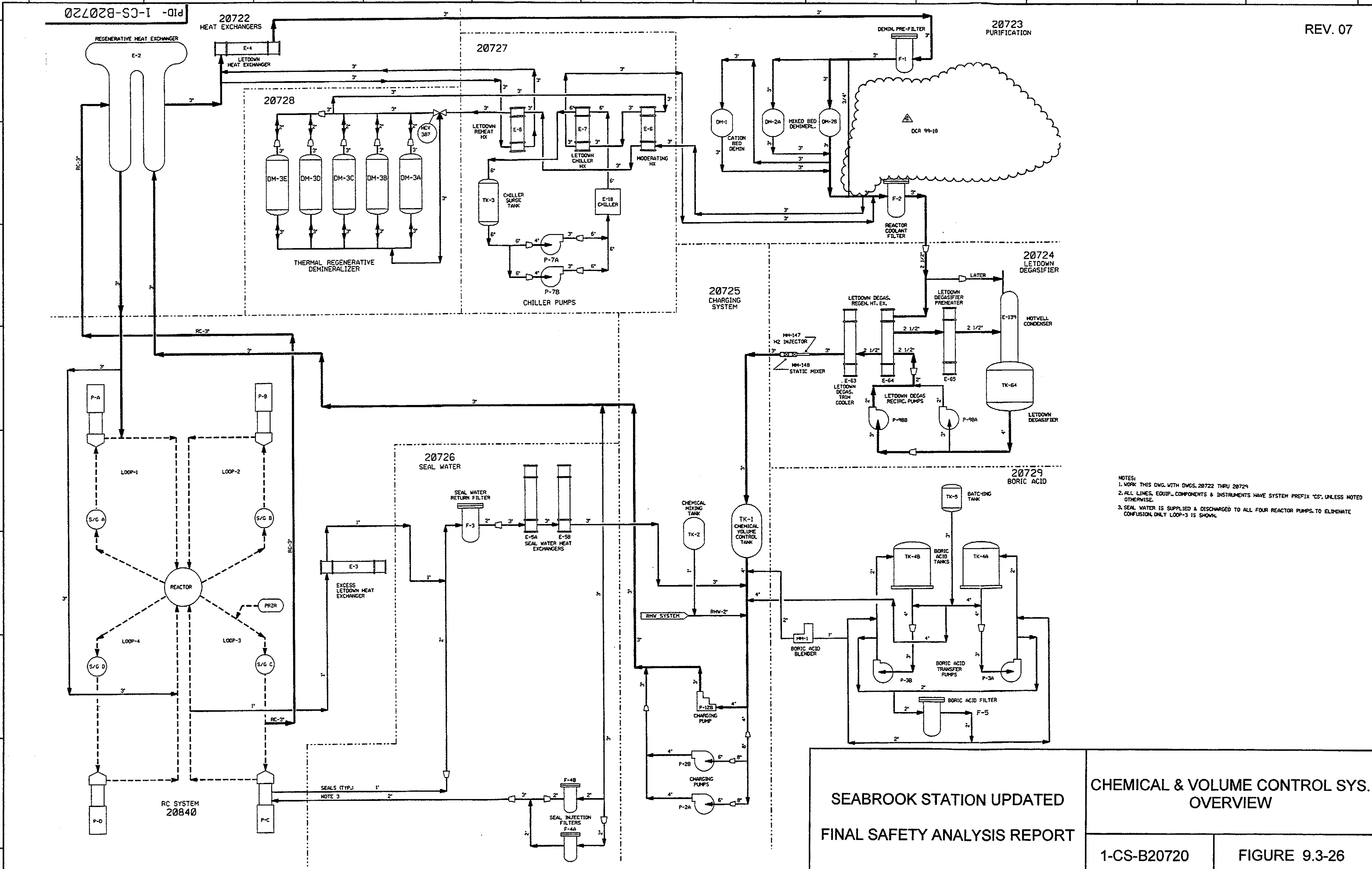
FINAL SAFETY ANALYSIS REPORT

WASTE PROCESSING LIQUID DRAINS
WASTE PROCESSING BUILDING
DRAINS
SHT. 2 OF 3

1-WLD-B20226

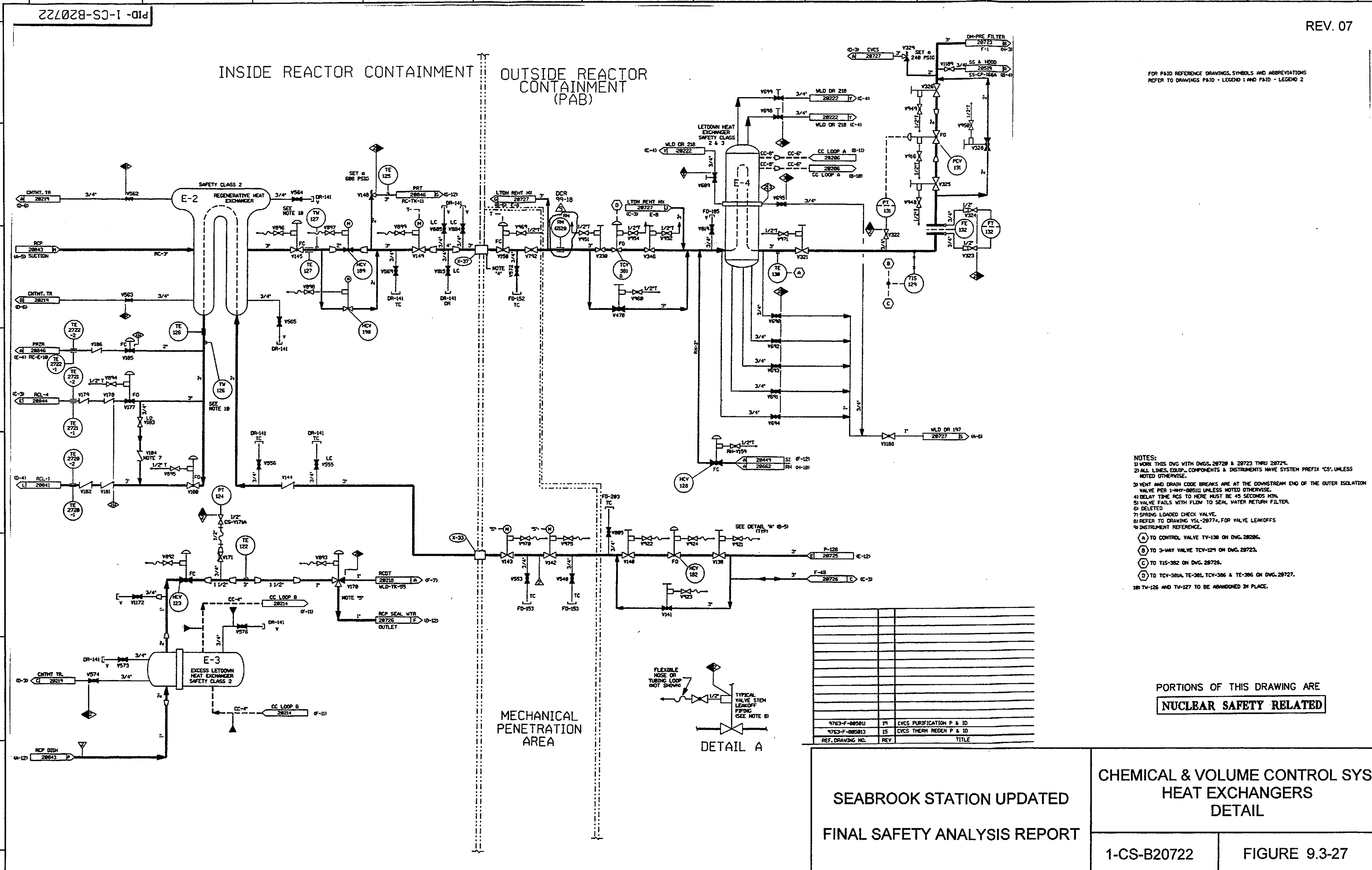
FIGURE 9.3-23 SH 2

07/11/00 REV. 6



NOTES:
1. WORK THIS DWG. WITH DWGS. 20722 THRU 20729
2. ALL LINES, EQUIP., COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX "CS", UNLESS NOTED OTHERWISE.
3. SEAL WATER IS SUPPLIED & DISCHARGED TO ALL FOUR REACTOR PUMPS. TO ELIMINATE CONFUSION, ONLY LOOP-3 IS SHOWN.

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	CHEMICAL & VOLUME CONTROL SYS. OVERVIEW
	1-CS-B20720 — FIGURE 9.3-26



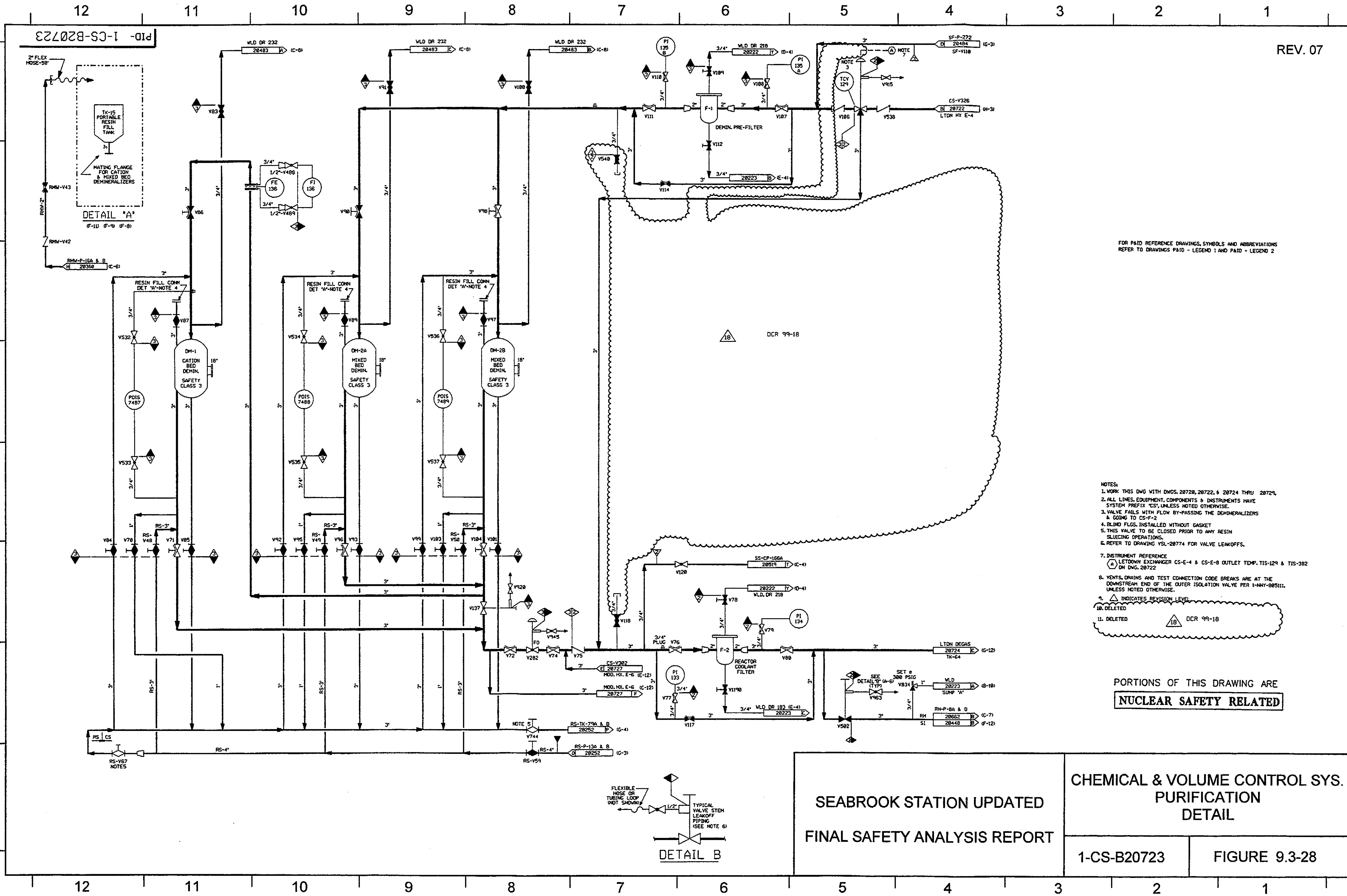
SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

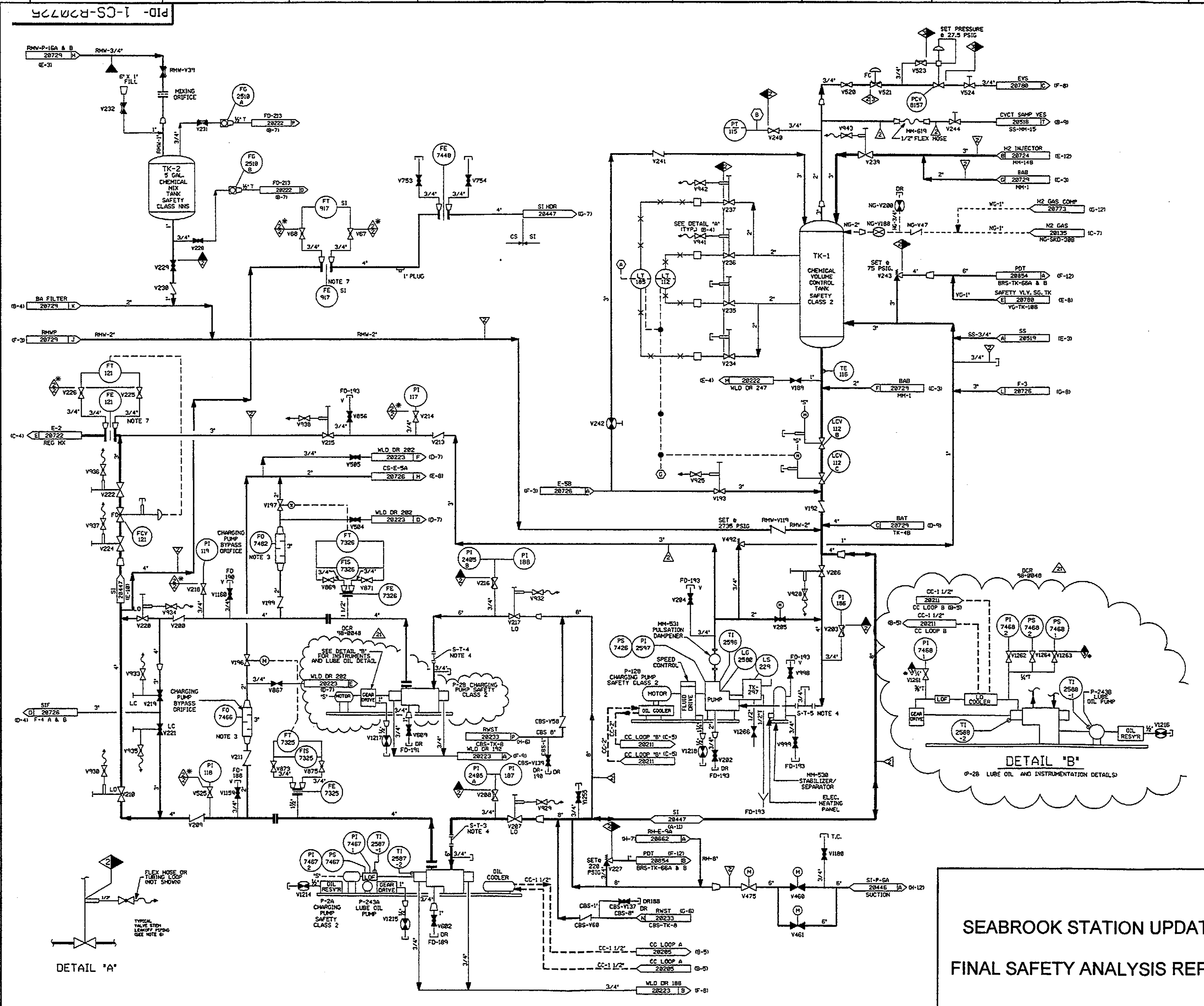
CHEMICAL & VOLUME CONTROL SYS.
HEAT EXCHANGERS
DETAIL

1-CS-B20722

FIGURE 9.3-27



11/03/00 REV. 18



REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

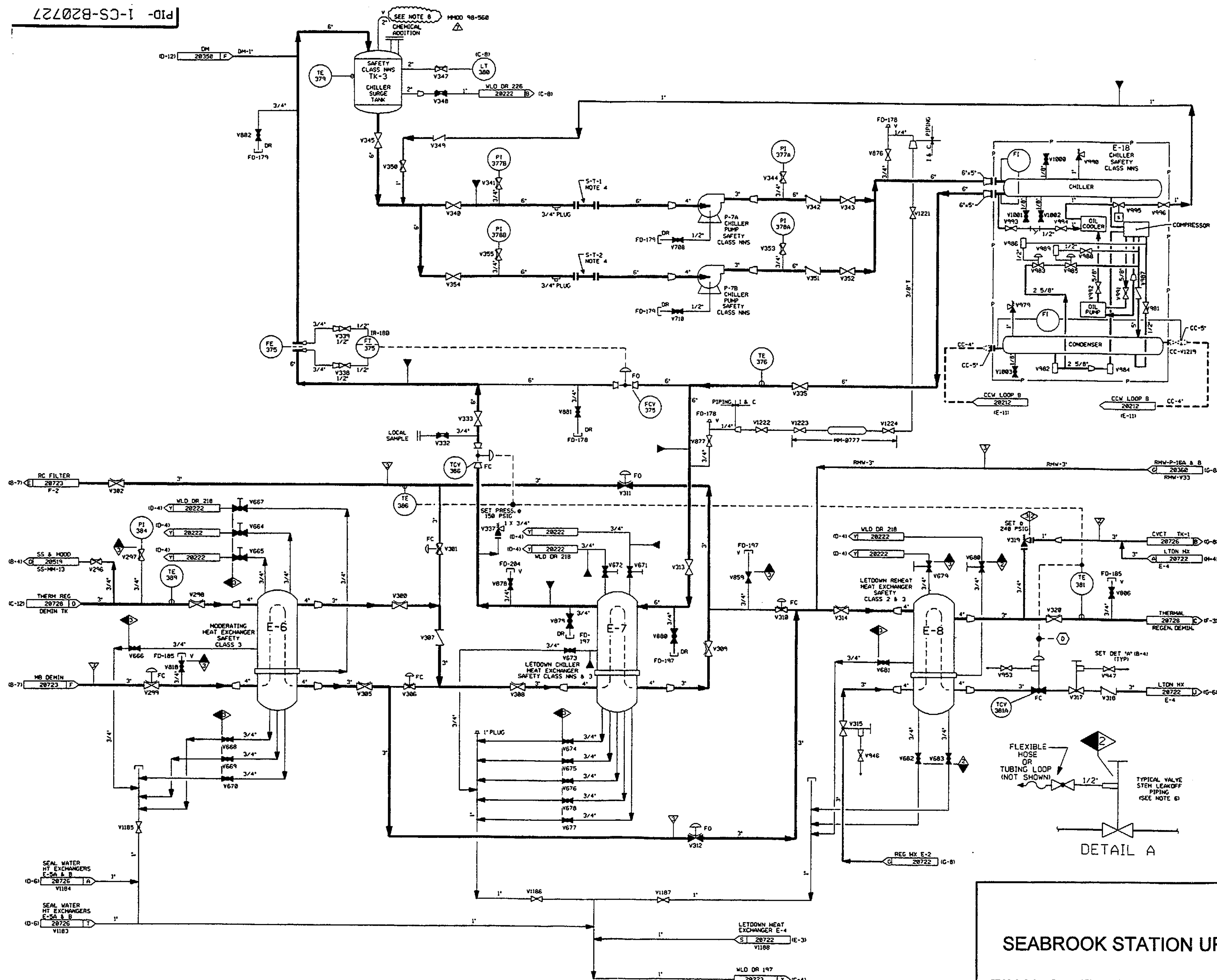
1. WORK THIS DWG WITH 20720 THRU 20724 & 20726 THRU 20729. PORTIONS OF THIS DRAWING ARE DUPLICATED ON DRAWING SI-20447 DUE TO DUAL SYSTEM FUNCTIONS.
2. ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX 'CS', UNLESS NOTED OTHERWISE.
3. MIN. OF 5' OF STRAIGHT RUN AFTER MIN. FLOW ORIFICE.
4. PERMANENT SPOOL PIECE INSTALLATION SHOWN TEMP. SPOOL PIECE WITH STRAINER, PRESSURE INSTRUMENTS, VENTS & DRAINS INSTALLED ONLY DURING FLUSHING OPERATIONS & IS REMOVED BEFORE START-UP.
5. VENT AND DRAIN CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-805111 UNLESS NOTED OTHERWISE.
6. REFER TO DRAWING VSL-20774 FOR VALVE LEAKOFFS.
7. ORFICE PLATE NON-ASME
8. INSTRUMENT REFERENCE
   - (A) TO LCV-112A & LV-112A ON DWG. 20724.
   - (B) TO WG-PIC-8156 ON P&ID WG-20773
   - (G) TO LCV-112E & LCV-112D ON DWG. 20233.
9. △ INDICATES REVISION LEVEL.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	CHEMICAL & VOLUME CONTROL CHARGING SYSTEM DETAIL	
	1-CS-B20725	FIGURE 9.3-30

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

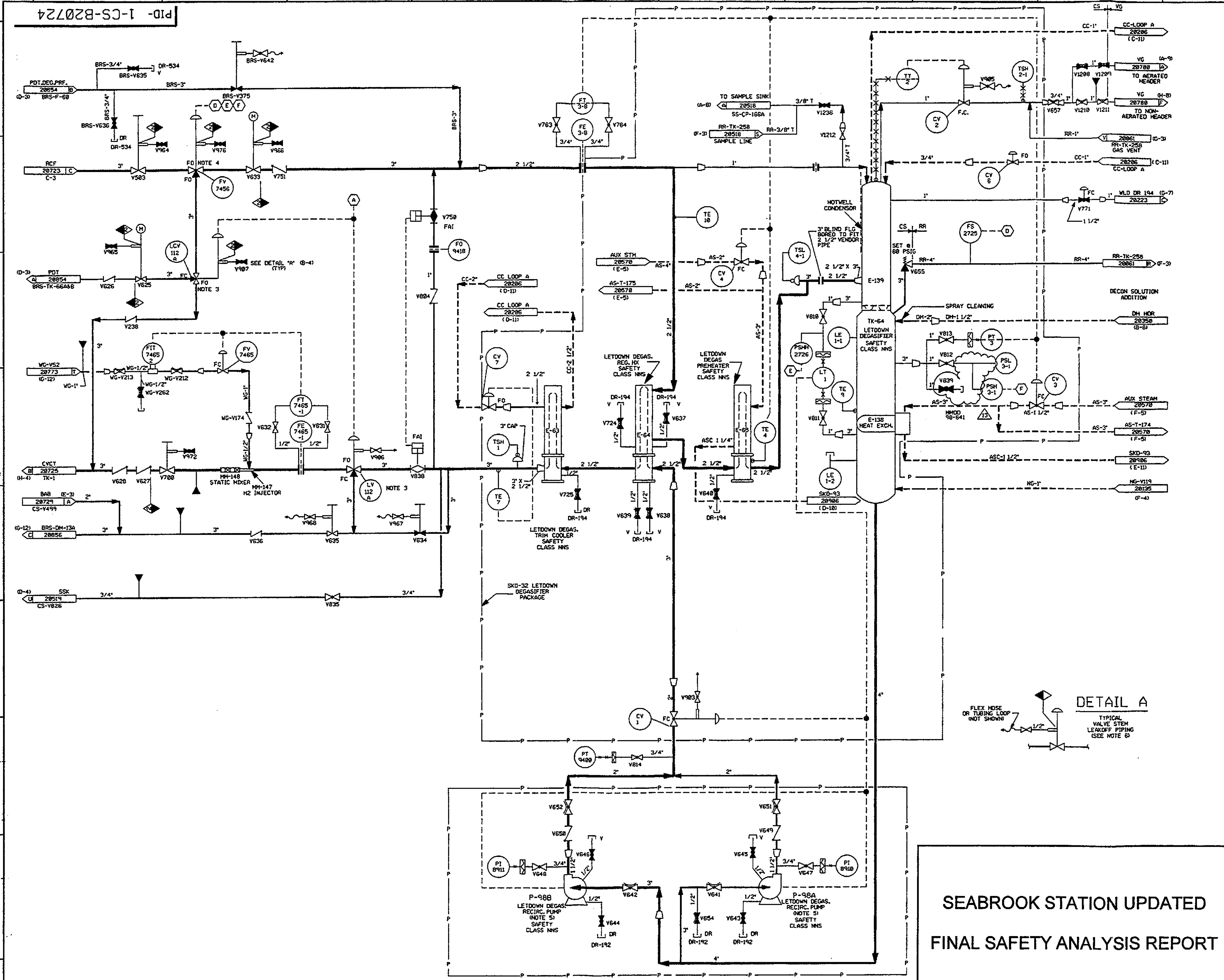
1) WORK THIS DWG WITH DWGS 20720 THRU 20726, 20728 & 20729.
2) ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX "CS", UNLESS NOTED OTHERWISE
3) MAIN FLOW SHOWN DURING BORATION PHASE.
4) PERMANENT SPOOL PIECE INSTALLATION SHOWN. TEMP. SPOOL PIECE WITH STRAINER, PRESS. INSTR., VENTS & DRAINS INSTALLED ONLY DURING FLUSHING OPERATIONS AND IS REMOVED BEFORE START-UP.
5) VENT AND DRAIN CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-605111 UNLESS OTHERWISE NOTED.
6) REFER TO DRAWING VSL-20774 FOR VALVE LEAKOFFS.
7) INSTRUMENT REFERENCES:
   (D) TO CONTROL VALVE TCV-381B ON DWG. B20722
8) WHEN CHILLLER LOOP IS IN DRY LAYUP, NITROGEN IS SUPPLIED THROUGH THE TANK VENT. (SEE PID NG-20136) MMOD 98-560

PORTIONS OF THIS DRAWING ARE **NUCLEAR SAFETY RELATED**

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	CHEMICAL VOLUME & CONTROL SYSTEM THERMAL REGENERATION DETAIL	
	1-CS-B20727	FIGURE 9.3-31 SH 1

PID- 1-CS-B20724

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DWG WITH DWGS 20720, 20722, 20723, & 20725 THRU 20729.
2. ALL PIPING, VALVES, EQUIP & INSTRUMENTS HAVE SYSTEM PREFIX 'CS', UNLESS NOTED OTHERWISE.
3. VALVE FAILS WITH FLOW TO CVCT
4. VALVE FAILS WITH FLOW TO LCV-112A
5. SEE DWG 20354 FOR WATER SUPPLY TO PUMP DOUBLE MECHANICAL SEALS.
6. REFER TO DWG VSL-20774 FOR VALVE LEAKOFFS.
7. INSTRUMENTATION REFERENCES
   (A) CHEM VOL CONTROL TK (CS-TK-1) LEVEL LT-112E & LT-185 ON DWG CS-20725
   (D)(E)(F) TO 1-CS-CV-3, 1-CS-CV-4 (AS-20570), 1-DM-V285 (DM-20350) AND 1-CS-FV-7456 (CS-20724).
8. △ INDICATES REVISION LEVEL

DETAIL A

TYPICAL VALVE STEM LEAKOFF PIPING (SEE NOTE 6)

FLEX HOSE OR TUBING LOOP (NOT SHOWN)

PORTIONS OF THIS DRAWING ARE **NUCLEAR SAFETY RELATED**

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

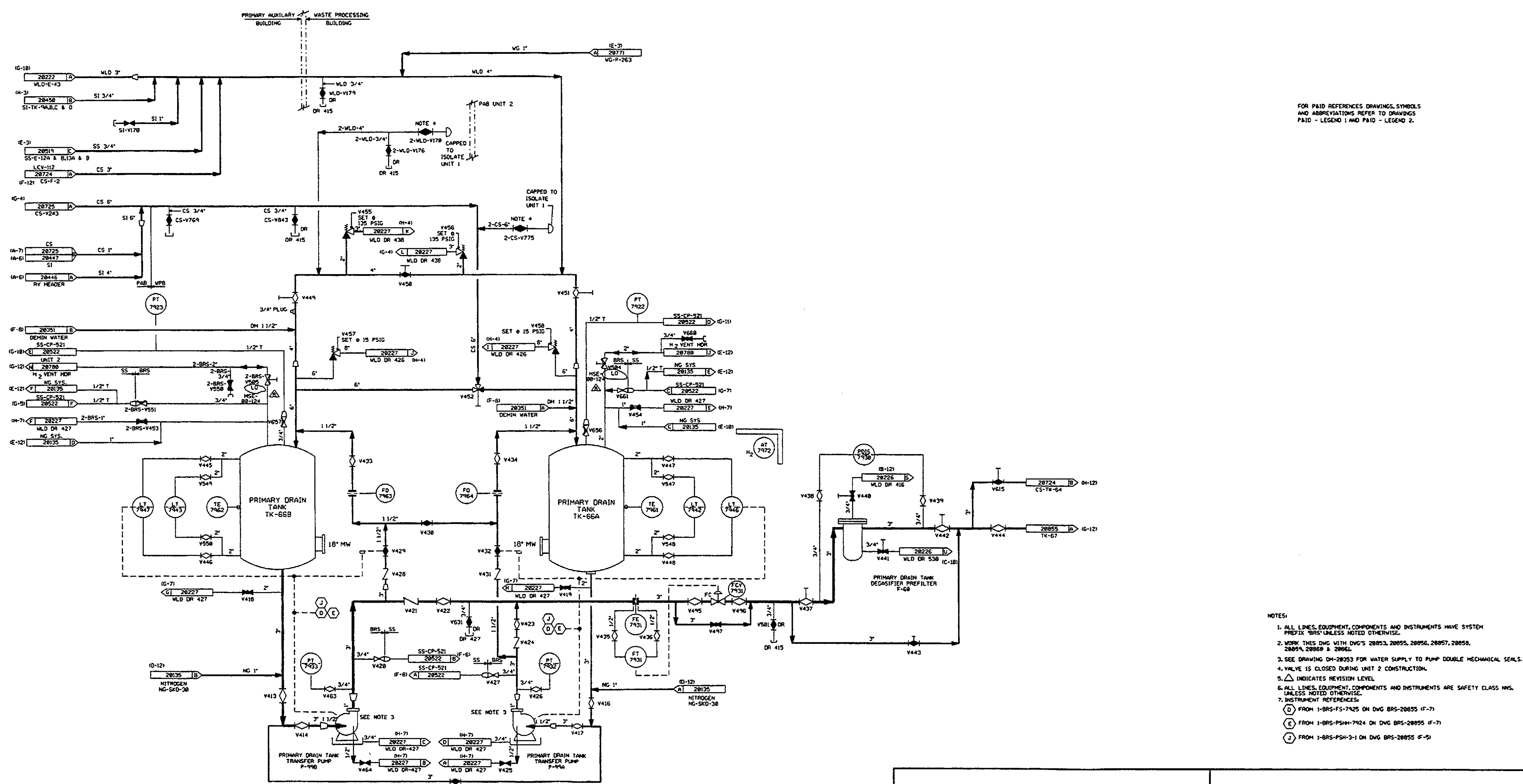
CHEMICAL & VOLUME CONTROL LETDOWN DEGASIFIER DETAIL

1-CS-B20724

FIGURE 9.3-33

PID- 1-BRS-B20854

REV. 07



SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

BORON RECOVERY SYSTEM DEGASIFICATION DETAIL

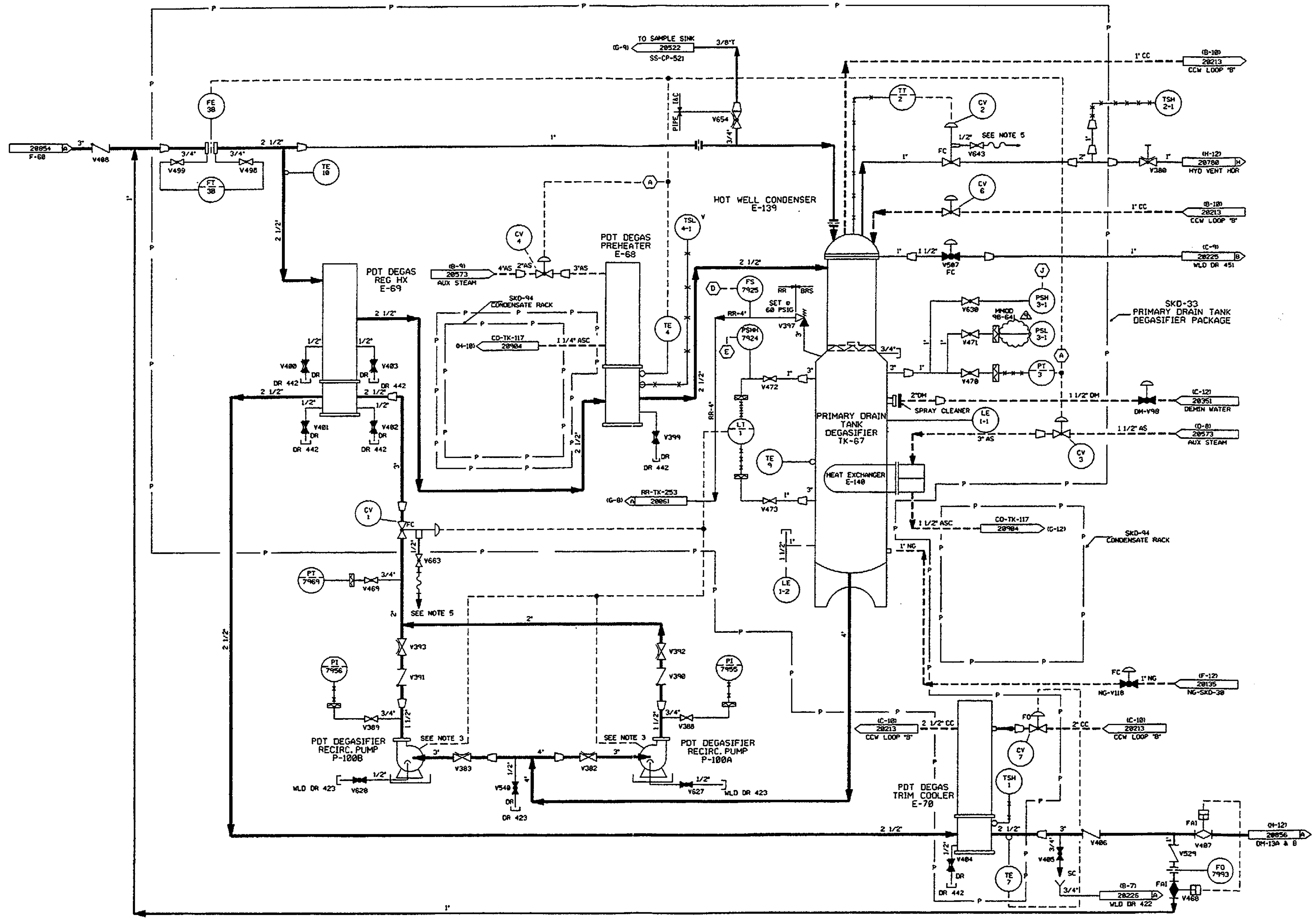
1-BRS-B20854

FIGURE 9.3-39 SH 1

05/30/00 REV. 08

PID- 1-BRS-B20855

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX 'BRS' UNLESS NOTED OTHERWISE.
2. WORK THIS DWG WITH DWG'S 20853, 20854, 20856, 20857, 20858, 20859, 20869 & 20861
3. SEE DWG DM-20354 FOR WATER SUPPLY TO PUMP DOUBLE MECHANICAL SEALS.
4. △ INDICATES REVISION LEVEL
5. REFER TO DRAWING VSL-20774 FOR VALVE LEAKOFF.
6. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS UNLESS NOTED OTHERWISE.
7. INSTRUMENT REFERENCES:
   (A) TO 1-BRS-CV-3 & 4 ON DWG AS-20573 (D-10).
   (D)(E)(J) TO 1-AS-CV-3, 1-AS-CV-4 ON DWG AS-20573 (D-9).
   TO 1-BRS-P-99A & B ON DWG BRS-20854 (C-8) (C-10).
   TO 1-DM-V98 ON DWG DM-20351 (C-12)

REF. DRAWING NO.	REV	TITLE
9763-F-805618	10	BORON RECOV SYS-PRIM DRAIN TK DEGAS P&ID

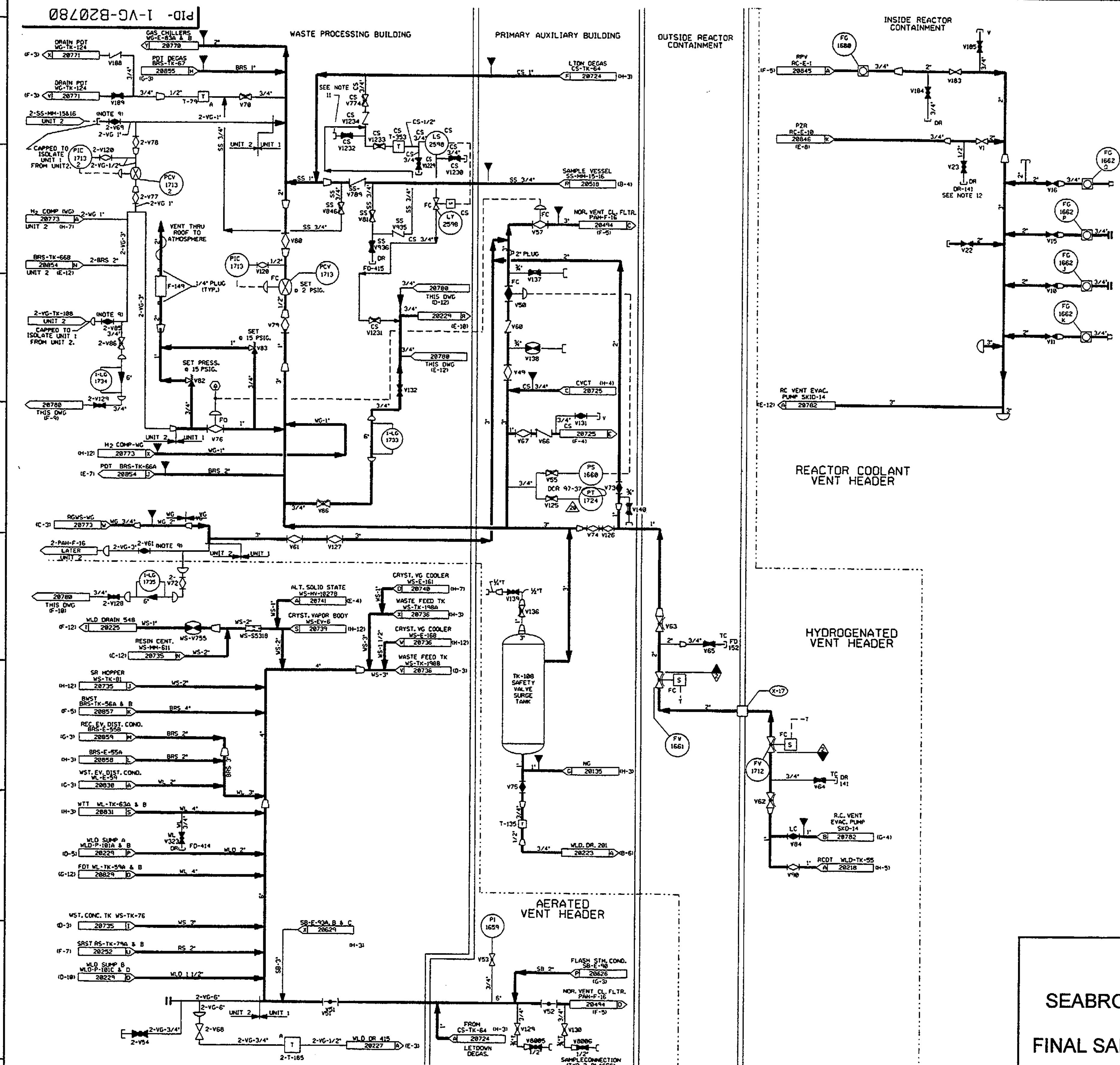
SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT

BORON RECOVERY SYSTEM DEGASIFICATION DETAIL

1-BRS-B20855

FIGURE 9.3-39 SH 2

08/31/00 REV. 09



REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH DRAWING 20779 & 20782.
2. DELETED
3. ALL PIPING, VALVES, EQUIPMENT AND INSTRUMENTS HAVE SYSTEM PREFIX VG UNLESS NOTED OTHERWISE.
4. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS UNLESS NOTED OTHERWISE.
5. DELETED
6. DELETED
7. DELETED
8. △ INDICATES REVISION LEVEL
9. 2-3"-VG-V61, 2-1" VG-V69 AND 2-3"-VG-V85 SHOULD BE CLOSED AND LOCKED DURING CONSTRUCTION OF UNIT NO 2.
10. (A) TO 2-3"-VG-V57 (UNIT 2) VG-V76 SHALL BE ADMINISTRATIVELY MAINTAINED OPEN BY ISOLATING THE AIR SUPPLY VALVE TO THE ACTUATOR DURING UNIT 2 CONSTRUCTION
11. INSTALL THREADED CAP WHEN HOSE CONN. IS NOT INSTALLED.
12. QUICK DISCONNECTS MAY BE INSTALLED UPSTREAM OF PIPE CAPS AS DEEMED NECESSARY BY STATION STAFF TO FAICILITATE VENT AND DRAIN OPERATIONS.

PORTIONS OF THIS DRAWING ARE
NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	VENT GAS SYSTEM
	1-VG-B20780 / FIGURE 9.3-41

9.4 AIR CONDITIONING, HEATING, COOLING AND VENTILATION SYSTEMS

This section describes the air conditioning, heating, cooling and ventilation systems employed in various plant buildings and structures.

The outside ambient conditions used for design of these systems and the inside design temperatures specified for these outside ambient conditions are summarized in Figure 3.11-1.

The areas containing equipment required to cope with a Station Blackout were evaluated for the effects of loss of ventilation (see Section 8.4.4.4). These areas include the emergency feedwater pumphouse, vital switchgear rooms, battery rooms, containment structure, main control room, electrical tunnels including electrical penetration area, mechanical penetration area and main steam/feedwater pipe chases including east electrical room and west stairwell. For all of these areas, the final calculated temperature at the end of the four-hour Station Blackout coping duration was acceptable.

9.4.1 Control Room Complex Heating, Ventilation and Air Conditioning System

Seabrook Station's control room complex occupies the entire 75'-0" elevation of the Control Building (see Figure 1.2-32). The HVAC systems that service the control room complex are described below and in Section 6.4, Habitability Systems. In addition, the redundant filter systems integral to the emergency makeup air and filtration subsystem are detailed in Subsection 6.5.1, ESF Filter Systems.

9.4.1.1 Design Bases

The air conditioning, heating and ventilation system for the control room complex is designed to maintain the temperature throughout the control room complex within design limits at all times, to dilute odors, smoke and other internal air contaminants, to retain airborne particulates and to absorb radioactive iodine which may penetrate the control room during accident conditions external to the control room.

On May 21, 1991, a complete revision to 10 CFR 20 was issued. Several design bases reference the old 10 CFR 20 and specific terms or parts of the old 10 CFR 20. Design bases information provides a historical perspective of the information used to formulate a particular design. References to the old 10 CFR 20 when used in a historical or design bases context have not been changed to reflect the revised 10 CFR 20.

The cooling system for both normal and emergency plant operation is designed to maintain the control room temperature at or below design maximum temperatures (refer to Figure 3.11-1) when the outside air temperature is 88°F or lower.

The heating system is designed to maintain the control room temperature at or above design minimum temperatures when the outside temperature is 0°F or above and when the control room is being supplied with 1000 cfm of outside air.

The control room complex air conditioning system is physically and operationally independent of the filtering, heating and ventilating of the remainder of the Control Building.

Exhaust fans/hoods have been installed over the chilled water condenser units to ensure that all the condenser unit exhaust heat is captured and removed from the area.

The control room HVAC equipment room is maintained at a positive pressure at least ⅛" w.g. greater than the outdoors and cable spreading room. During normal operations, this positive pressure is maintained by the normal makeup air subsystem and the exhaust and static pressure control subsystem. The exhaust control damper modulates to control the HVAC equipment room static pressure as described in Subsections 6.4.2.2 and 6.4.2.4. Under emergency conditions, the positive pressure is maintained by the emergency makeup air and filtration subsystem. The normal makeup air and air exhaust and static pressure control subsystems isolate, and the emergency makeup air and filtration subsystem actuates automatically under accident conditions (high intake radiation, "S" signal). The control room proper is maintained at a slightly greater pressure than the HVAC equipment room. Control room pressurization precludes the infiltration of hazardous contaminants.

The control room air conditioning system consists of a redundant safety related chilled water subsystem and a diverse non-safety related chilled water subsystem. Both of these systems use a chilled water solution with ethylene glycol to provide freeze protection. The safety related and non-safety related chilled water cooling coils share common safety related air handling units which supply conditioned air to the control room. Safety related exhaust fans are provided above each safety related chiller to remove heat exhausted by the chiller condenser fans during operation.

Modular microprocessor based digital control systems are provided to coordinate stand-alone operation of each chiller. The digital control system for each chiller consists of a network of modules with embedded firmware that receives analog and binary inputs from various sensors. The inputs are processed and outputs are supplied in the form of modulating voltages and contact operation to control operation of the chiller compressors, refrigerant valves and condenser fans to maintain a set evaporator leaving water temperature. The digital chiller controls also provide a high level of equipment protection functions that keep the cooling system operating safely within predetermined parameters.

During low outside ambient temperature conditions, chiller head pressure control is maintained by reducing condenser fan capacity. Condenser fans are staged based on saturated condensing temperature. Head pressure control is further enhanced on the safety related chillers by microprocessor based variable speed fan drive units, one for each cooling circuit on each chiller. These drive units modulate speed of the condenser fans in relation to saturated condensing temperature to allow stable compressor operation to 0°F. During normal plant operation the non-safety subsystem is usually aligned to provide control room cooling. One of the safety-related trains is aligned for automatic operation while the redundant train is placed in standby. The condenser exhaust fans are normally aligned for automatic operation on a demand signal for chiller operation. The safety-related train that is aligned for automatic operation has the same train designation as the control room air handling unit that is aligned to support operation of the non-safety-related subsystem.

Following a loss of offsite power, the non-safety chilled water subsystem shuts down since it is not connected to emergency power. Subsequently, an automatic start sequence is initiated for the safety related chilled water system by the emergency Diesel Generator Load Sequencer. The corresponding control room air handling unit, condenser exhaust fan and chilled water pump start prior to operation of the chiller.

In the event that the chilled water subsystem aligned for automatic operation fails to operate, operator actions will be taken to start the redundant train of chilled water equipment from the MCB. Similar actions will be taken to start one of the redundant safety related chilled water systems if the non-safety subsystem fails.

The capability for alignment of one train of the safety-related CBA subsystem for maintained operation is also provided via the controls on the Main Control Board.

No single active failure will cause a loss of both safety-related control room complex air handling units or chilled water systems. No single active failure will cause a complete loss of control room makeup air and subsequent loss of control room pressurization (as clarified in paragraph 9.4.1.2c). No single active failure will disable the normal makeup air automatic isolation function. No single active failure will cause a loss of both emergency filtration systems. No operator actions outside of the control room will be required to support alignment of redundant equipment in response to a single active failure of the control room complex air handling unit, chilled water systems or condenser exhaust fans.

Normally, the non-safety related system is in operation. However, the safety-related control room air conditioning system is capable of the following functions normally and following a LOCA, a safe shutdown earthquake or a tornado: condition the room air as required, distribute the conditioned air throughout the control room, filter the recirculated and makeup air of particulates and collect the spent air from the control room for reconditioning.

The control room normal makeup air subsystem is capable of performing the following functions during normal operations and following a LOCA, a safe shutdown earthquake or a tornado: maintain a positive pressure within the complex at all times (except when positive pressure is maintained by the emergency makeup air and filtration subsystem as described below) with respect to adjacent areas and the outside atmosphere to prevent the infiltration of air from local areas that could under certain circumstances contain objectionable contaminants and supply ventilation air for the occupants, isolate automatically in the presence of a high intake radiation signal or upon actuation of the emergency makeup air and filtration subsystem.

The control room emergency makeup air and filtration subsystem is capable of performing the following functions during normal operation, and following a LOCA, a safe shutdown earthquake or a tornado: maintain a positive pressure with the complex at all times with respect to adjacent areas and the outside atmosphere, supply ventilation air for the occupants, filter all makeup air and a portion of recirculated air for removal of airborne particulates and iodines, and heat the air within each filter to maintain the relative humidity less than or equal to 70 percent to optimize the charcoal adsorption efficiency.

The control room exhaust and static pressure control subsystem is capable of automatic isolation normally and following a LOCA, safe shutdown earthquake, or a tornado in the presence of a high intake radiation signal or upon actuation of the emergency makeup air and filtration subsystems.

The isolation functions for the control room normal makeup air subsystem and the exhaust and static pressure control subsystem are designed to remain functional during and after a SSE concurrent with an assumed loss of offsite power and a single active failure.

All vital components of the safety-related control room air conditioning subsystem and emergency makeup air and filtration subsystem are designed to remain functional during and after an SSE concurrent with an assumed loss of offsite power and a single active failure.

The safety-related control room complex HVAC systems are housed in seismic Category I structures designed to withstand the effects of flooding and tornado missiles except for a portion of the west makeup air intake piping. The unshielded piping associated with this intake has a low mean value probability, calculated in the range of 2×10^{-9} to 3×10^{-7} per year for tornado missile impact. The intake opening is located several feet above grade and is therefore not susceptible to the effects of flooding. Wind and tornado loadings are discussed in Section 3.3; flood design in Section 3.4; and internal and external missiles in Section 3.5. Protection against dynamic effects associated with the postulated rupture of piping is discussed in Section 3.6. Environmental design of piping is discussed in Section 3.6. Environmental design of mechanical and electrical equipment is discussed in Section 3.11.

The safety-related control room air conditioning subsystem components are ANSI

Safety Class 3 and seismic Category I, except for the cooling coil filters, the unit heaters (room), and the recirculating air damper.

The non-safety related subsystem chilled water coiling cools are ANS Safety Class 3 and Seismic Category I. The associated piping in the mechanical room is non-safety related, but designed and constructed in accordance with position C.2 of Reg. Guide 1.29. The remainder of the system is non-safety related and non-seismically supported. The fans, dampers, damper actuators, controls and piping of the normal makeup air subsystem are ANSI Safety Class 3, seismic Category I. The fans, dampers, damper actuators, filters, vital controls, vital instrumentation, and piping/ductwork of the emergency makeup air and filtration subsystem are ANSI Safety Class 3 and seismic Category I. The filtration system also satisfies the design criteria of Regulatory Guide 1.52 as clarified in Updated FSAR Subsection 6.5.1. The redundant exhaust and static pressure control subsystem dampers, damper actuators, and vital controls required for system isolation are Safety Class 3 and seismic Category I. The control room static pressure control loop that modulates the exhaust control damper under normal conditions is nonsafety-related. Ductwork for the exhaust and static pressure control subsystem from the exhaust control/isolation damper to the tornado damper, including the redundant isolation damper, is ANSI Safety Class 3 and seismic Category I. The control room exhaust fan, the remaining exhaust and static pressure control subsystem ductwork, and the computer room air conditioning unit are nonsafety-related and nonseismic Category I.

The codes and standards used in the design, fabrication and installation of the control room air conditioning system are as follows:

a. The safety-related water chillers, safety-related chilled water pumps, safety-related cooling coils, safety-related chiller condenser exhaust fans, and safety-related backdraft dampers are in accordance with manufacturer's standards. Quality standards are maintained by the use of Appendix "B" suppliers and the "commercial grade dedication" process.

b. Chilled water piping (NNS) design in accordance with ANSI B31.1 (1987) and ASHRAE Systems & Equipment (1996)

c. The electric components, control components and overload protection systems are designed and fabricated in accordance with the codes and standards identified in Updated FSAR Subsection 8.1.5.

d. Safety-related chilled water piping design is in accordance with ANSI B31.1. Quality standards are maintained via the use of Appendix "B" suppliers and the "commercial grade dedication" process.

e. Fabrication and installation are under all applicable QA and QC standards for the safety class and seismic requirements for the system.

f. The digital chiller and variable speed fan control firmware and hardware were verified using guidance provided in the guidelines, codes and standards identified in Table 9.4-1A.

Additional codes and standards used for HVAC system components are summarized in Table 9.4-1. See Table 9.4-17 and Table 9.4-17a for control room complex air conditioning system performance information and Table 9.4-18 for the control room complex makeup air and cleanup filtration system performance information.

The digital computer based control equipment used to support operation of the safety related chillers and fan variable speed drive units were reviewed and qualified for the control room air conditioning system application. The approach emphasizes consideration of the effects of potential failure modes within the system software and hardware, as well as the potential effects of electromagnetic interference. Industry standards and guidance, licensing guidance and commercial grade component dedication procurement activities are integrated to provide reasonable assurance that the digital equipment will be highly reliable when performing the required safety functions.

EPRI reports NP-5652, TR-102348 and IEEE Standard 7-4.3.2 were applied by a third party supplier as the primary source of guidance for qualification and dedication of the chiller and variable speed drive digital controls in accordance with the requirements of 10 CFR 50, Appendix A. Applicable portions of the guidelines, codes and standards noted on Table 9.4-1B were also applied to support qualification of these components for this application. Design and performance of the chiller were verified by test, inspection or observation as part of equipment dedication to provide reasonable assurance that the equipment will be reliable in performance of the intended safety function.

The guidance provided in IEEE Standard 7-4.3.2 was used to support acceptance of the operating system embedded functions (firmware). Control system functional performance verification and validation testing and source surveillance of the original equipment manufacturer were performed to ensure reliability and dependability of the integrated chiller and variable speed drive digital control hardware and firmware.

The qualification program also included proof testing in accordance with IEEE 344 and IEEE 323, electromagnetic and radio frequency interference qualification testing in accordance with EPRI TR-102323 and mild environment qualification by analysis in accordance with IEEE 323.

9.4.1.2 <u>System Description</u>

The control room complex HVAC system (see Figures 9.4-1 through 9.4-3 and 9.4-25) consists of the following subsystems:

Control room safety-related air conditioning subsystem

Control room non-safety related chilled water system

Computer room air conditioning subsystem

Control room normal makeup air subsystem

Control room emergency air makeup and filtration subsystem

Control room exhaust and static pressure control subsystem.

a. Control Room Air Conditioning Subsystem

The control room air conditioning subsystem includes both safety-related and non-safety related cooling subsystems. The safety-related and non-safety related cooling subsystems share a common recirculating air system located on elevation 75'-0" within the control room complex.

The safety-related control room air conditioning subsystem consists of two full-sized identical air cooling trains that are independently electrically powered. One train is supplied from emergency Bus A, and the other from emergency Bus B. Each train consists of:

(1) a 100% capacity electric motor-driven water chiller,
(2) two (2) 100% capacity chilled water circulating pumps,
(3) one (1) 100% capacity chiller condenser exhaust fan,
(4) a backdraft damper,
(5) a 100% capacity air handling unit located in the recirculated control room air cooling stream, and
(6) interconnecting piping, expansion tank and instrumentation and controls.

Each electric motor-driven chiller is a factory fabricated package unit consisting of two (2) equal capacity refrigerant circuits with each circuit consisting of two (2) scroll type refrigeration compressors, a shell and tube evaporator and an air cooled condenser. The water chillers are located in the Diesel Generator Building mechanical equipment room on elevation 51'-6".

The chilled water recirculating pumps are electric motor driven, and are of the centrifugal type. These pumps circulate a glycol/water mixture through an air-cooled liquid chiller. The pumps are located in the Diesel Generator Building mechanical equipment room on elevation 51'-6".

The chiller condenser exhaust fans capture the heat rejected from the chillers into the mechanical equipment room and exhausts it to the outside via exhaust ductwork. They are located in the Diesel Generator Building mechanical equipment room on elevation 51'-6".

Each air handling unit consists of a medium efficiency flat filter, a cooling coil section and a fan section. The cooling coil section houses the safety-related chilled water cooling coil as well as the non-safety related cooling coil. One of the two (2) air handling units is always in operation irrespective of whether the non-safety related chilled water system or the safety-related chilled water system is in operation.

The air handling unit with its associated safety-related refrigeration equipment is designed to produce 58.7 tons of refrigeration, and is sized to meet the design emergency conditions requiring 53.1 tons of refrigeration, during normal plant conditions, the control room air conditioning subsection can provide cooling to supplement the computer room if the computer room air conditioning unit is unavailable.

The non-safety related subsystem includes two chilled water pumps located in the Administration and Services Building mechanical room 1B. Each pump circulates a glycol/water mixture through an air-cooled liquid chiller located on the Administration and Services Building roof. The chilled water is then delivered to a chilled water cooling coil mounted within each of the safety related CBA evaporator fan units located in the Control Building, elevation 75 ft. mechanical room. Safety-related evaporator fan units CBA-FN-14A or 14B distribute and circulate the cooled air throughout the control room complex.

The non-safety related control room air conditioning subsystem will normally operate. In the event of a malfunction in the non-safety related subsystem, or during a loss of offsite power, one of two 100% capacity safety-related trains of control room air conditioning will be placed in service manually.

The control room is supplied with conditioned air through a sheet metal duct system that is seismic Category I supported. Air is distributed through diffusers, as necessary, to maintain design room temperature. Return air is drawn from the control room through return air registers into the plenum above the ceiling. The return air is then drawn through the plenum and passes through the return air openings in the wall between the plenum and the mechanical equipment room. The return air, together with the makeup ventilation air, is drawn through the air conditioning unit for conditioning and recirculation.

b. Computer Room Air Conditioning Subsystem

The computer room air conditioning subsystem has a recirculating air system which consists of a vertical unit located in the computer room. Conditioned air is discharged from the unit into a raised floor and then into the room through grills in the raised floor. Air is then returned through the face grills on the unit. The temperature and humidity controllers are factory installed and wired within the unit.

A glycol supply and return water system is used to remove the room heat load, using pumps and a dry cooler located on the Diesel Generator Building roof.

The control room air conditioning system ductwork contains manually controlled air dampers which in the open position permit utilization of the control room air conditioning capacity should the computer room air conditioning system be unavailable. The computer room ductwork is seismically supported, nonsafety-related.

c. Control Room Normal Makeup Air Subsystem

During normal plant operation, the control room normal makeup air subsystem is aligned to deliver approximately 1000 cfm of outside air from both remote intakes (500 cfm per intake). With one normal makeup air fan operating and its associated discharge damper open, the intake isolation valves are positioned to allow equal amounts of air to be drawn from the east and west intakes. The east air intake is protected against tornado missiles by a reinforced concrete structure (see Figure 6.4-1). A portion of the west air intake is not protected against tornado missiles (see Figure 6.4-2). However, the low effective target area results in a low mean value probability, calculated in the range of 2×10^{-9} to 3×10^{-7} per year, for tornado missile impact. The normal makeup air flows through the prefilter and heater for each emergency filter unit and discharges via an orifice plate into the HVAC equipment room. The heater for each unit operates continuously to maintain the humidity at or below 70 percent RH. The prefilters are periodically replaced when the differential pressure across the filters increases to a predetermined value, as a result of particulate buildup.

The continuous supply of makeup air to the control room HVAC equipment room maintains the complex at a positive pressure with respect to the outside and adjacent areas. This positive pressure precludes the infiltration of hazardous contaminants. The control room is maintained at a slightly greater positive pressure than the HVAC equipment room. The supply air also provides adequate air changeout to preclude the buildup of stale air and noxious odors.

In the event normal makeup air fails or is isolated for reasons other than those delineated in Subsections 6.4.3.2 and 6.4.3.3 and below, appropriate operator action will be taken to re-establish makeup air. If makeup air is lost because of fan failure, the redundant normal makeup air fan and its discharge damper will be manually actuated. If makeup air is lost because of a vital bus outage or failure, or a loss of instrument air supply to the dampers, the emergency makeup air filtration subsystem will be manually actuated.

The remote air intakes are monitored for radiation and smoke. Each intake is designed with two fully redundant radiation monitoring systems. Following an accident when high radiation is detected in either remote air intake or when the emergency makeup air and filtration subsystem fans are actuated, the normal makeup air fans automatically trip off and their associated discharge dampers automatically close. The control systems for these fans and dampers are "cross-trained." That is, the discharge damper associated with the Train A fan is controlled by the Train B control loop and vice versa. This configuration ensures isolation of the normal makeup air subsystem by fan trip and/or damper closure regardless of any single active failure.

Each intake is provided with smoke detection capability to automatically alarm and permit operator-initiated isolation of the control room normal makeup air subsystem. This isolation procedure would include manually starting the emergency cleanup filtration subsystem from the main control board, which automatically isolates the normal makeup air subsystem. The HEPA filters associated with this filtration subsystem will remove smoke from incoming air. The effected intake can then be manually isolated.

All of the active components of the normal makeup air subsystem are redundant, and all are independently powered and controlled from independent emergency buses so that no single failure will impose operational limitations.

Instrumentation and controls for the subsystem are described in detail in Subsection 6.4.6.1.

d. <u>Control Room Emergency Makeup Air and Filtration Subsystem</u>

Following an accident, when high radiation is detected at either remote intake, or upon generation of an 'S' signal, both redundant emergency makeup air fans and their associated discharge damper are automatically actuated. Although the redundant filter system fans are designed to operate coincidently and stably in their parallel configuration, Operations may, at their discretion, shut down one of the systems during the course of the accident. Each filter system may also be initiated manually upon detection of smoke in either remote intake (see Subsections 6.4.3.2 and 9.4.1.2c).

Each emergency makeup air and filtration subsystem has a nominal capacity of 1100 cfm. This capacity is comprised of 600 cfm makeup air and 500 cfm recirculation air. These system flow rates have been calculated assuming both remote intake isolation valves are open to a throttle position allowing for 300 cfm makeup air from each intake. Following an accident, a contaminated remote intake does not have to be manually isolated. Design base analyses indicate that the makeup air dilution factor (i.e., 50 percent makeup air from "clean" intake, 50 percent air from contaminated intake) and the radioactive particulate and iodine removal capacity of the filters together are adequate to maintain control room doses below allowable limits for the 30-day accident mitigation period.

The compliance of the filter systems to Regulatory Guide 1.52 is outlined in Table 6.5-2. Additional filter design details are provided in Subsection 6.5.1 and Table 6.5-5.

The gross volume of the control room complex is approximately 246,000 cubic feet. Therefore, operation of the emergency makeup air and filtration subsystem at a nominal flow rate of 1100 cfm will effectively filter the entire control room complex air in approximately 224 minutes. Instrumentation and controls for the subsystem are described in detail in Subsection 6.4.6.2.

All active components of the emergency makeup air and filtration subsystem are redundant, and are all independently powered from

emergency buses and controlled so that no single failure will impose operational limitations.

e. Control Room Exhaust and Static Pressure Control Subsystem

During normal plant operation, the control room exhaust fan is operating and its discharge control damper modulates to maintain the control room complex at a pressure of at least $+\frac{1}{8}$" w.g. with respect to adjacent areas. The redundant exhaust isolation damper remains fully open.

The pneumatically-operated modulating damper in the exhaust ductwork controls the amount of air being exhausted and, thereby, maintains a positive pressure within the control room complex. The damper is under the control of three static pressure sensing devices. The first pressure sensing point for the complex is in the HVAC equipment room, which is at a slightly lower positive pressure than the remainder of the control room envelope. The mechanical equipment room, the second pressure sensing point, is kept at least $\frac{1}{8}$" w.g. above the outside atmospheric pressure and at least $\frac{1}{8}$" w.g. above the cable spreading room at all times, which is the third pressure sensing point.

Detection of high radiation in either remote makeup air intake or operation of either emergency makeup air and filtration subsystem fan will automatically isolate the exhaust and static pressure control subsystem. Under emergency conditions the exhaust subsystem remains isolated at all times.

During normal operation, 1000 cfm of makeup air will be delivered to the control room complex. Approximately 145 cfm will be exfiltrated and the remaining 855 cfm will be exhausted. Under emergency conditions, approximately 600 cfm of makeup air will be delivered to the control room complex all of which will be exfiltrated.
The isolation control function for each exhaust isolation damper is powered from an independent emergency bus. No single active failure will preclude the automatic isolation of the exhaust and static pressure control subsystem.

Additional instrumentation and control details are provided in Subsection 6.4.6.3.

9.4.1.3 Safety Evaluation

The operation of all HVAC mechanical equipment is controlled and monitored in the control room complex. Additional details on system instrumentation and controls are provided in Subsection 6.4.6.

Control room habitability under all accident conditions is assured by a continuous supply of makeup air and resultant pressurization of the complex. If control room pressurization is temporarily lost under normal/nonaccident conditions, manual actuation from the control room of the emergency makeup air and filtration subsystem will re-establish positive pressure using the bypass piping. The remote location of the air intakes from each other and from potential radiological release sources provides dilution of contaminants in the makeup air which, in conjunction with the system's particulate and iodine filtration efficiency, satisfies control room dose criteria specified in 10 CFR 50, Appendix A, GDC 19 and Section 6.4 of the Standard Review Plan.

All active components in the normal makeup air subsystem, emergency makeup air and filtration subsystem, and exhaust and static pressure control subsystem, except the exhaust fan, are designed ANS Safety Class 3 and seismic Category I. The exhaust fan is designed NNS.

The filtration systems, including associated fans and dampers, are designed as Engineered Safety Features (ESF) in accordance with Regulatory Guide 1.52 (as clarified in Subsection 6.5.1) and Subsection 6.5.1 of the Standard Review Plan. The filter trains are fully redundant.

All redundant active electrical components are powered by separate and independent trains of emergency power from the diesel generators. Pneumatically-actuated system dampers are designed to fail in the safe position as follows:

Normal Makeup Air Discharge Damper	(CBA-DP-53A)	Fail Closed
Normal Makeup Air Discharge Damper	(CBA-DP-53B)	Fail Closed

Exhaust and Static Pressure Control Damper	(CBA-DP-28)	Fail Closed
Exhaust Isolation Damper	(CBA-DP-1058)	Fail Closed
Emergency Makeup Air Discharge Damper	(CBA-DP-27A)	Fail Open
Emergency Makeup Air Discharge Damper	(CBA-DP-27B)	Fail Open

In addition, the piping that bypasses the normal makeup air fans and dampers is provided with redundant backdraft dampers configured in parallel. This design ensures that an emergency makeup air flow path is available in the event one of the backdraft dampers fails to open upon actuation of the emergency makeup air fans.

Failure of a condenser exhaust fan backdraft damper to open is detected by high exhaust fan differential pressure. The exhaust fan and associated chiller are tripped to prevent the release of excessive heat, which could affect other HVAC systems.

The redundant and fail-safe damper design or low flow trips ensures that the system will perform its safety-related functions regardless of any single active failure. The system is designed to satisfy 10 CFR 50, Appendix A, criteria for single active failure.

The motors for the normal and emergency makeup air fans are designed Class 1E. The electric air heaters associated with each filter are also Class 1E. All electrical, instrumentation, and control systems that perform vital control functions are designed Class 1E in accordance with IEEE Standard 279-1971, and otherwise satisfy existing commitments in Chapters 7 and 8 of the Updated FSAR.

The makeup air duct upstream of the redundant emergency filters and external to the control room complex envelope is heavy-wall carbon steel pipe designed to remain intact and functional following a seismic event. The filter housings, discharge ductwork, and all other passive system components are also designed to remain intact and, except for some instrumentation which does not provide vital control or monitoring, remain functional following a seismic event. All portions of the makeup air system external to the control room complex envelope are designed to minimize inleakage.

All safety-related active and passive components of the system are contained in missile-protected buildings or are underground except for a portion of the west makeup air intake. The unshielded piping associated with this intake has a low mean value probability, calculated in the range of 2×10^{-9} to 3×10^{-7} per year, for tornado missile impact. No internally generated missiles which could impair the system's ability to perform its safety-related functions are credible.

The safety-related control room air conditioning system's water chillers, cooling coils, circulating pumps, air handling unit fans, condenser exhaust fans, and filter are redundant and are independently supplied with power so that no single failure will impose operational limits. The heating system's room unit heaters are not required to maintain the operation of the control room; therefore, redundant unit heaters are not provided. Power is supplied to these unit heaters from non-safety related busses.

The nonseismic components or systems located in the control room complex are located so that if failure due to a seismic event should occur, no damage will occur to safety-related components, equipment, or systems located in the control room complex. Nonseismic components located adjacent to safety class components have been analyzed to assure that they will not overturn or fail in such a way as to damage safety class components. Nonseismic, nonsafety-related components are electrically isolated and mechanically independent from safety-related components.

Both the non-safety related water chillers and the safety-related water chillers are provided with protective devices to prevent high refrigerant discharge pressure.

Further, the non-safety related water chillers are located outside, on the roof of the Administration Building. Any refrigerant discharge from them has no effect on control room habitability. The safety-related water chillers are located in the diesel generator mechanical equipment room outside the control room pressure envelope. Therefore, any refrigerant discharge from them, similarly, has no impact on control room habitability. Additionally, a conservative analysis has been performed to show that in the unlikely event that the entire refrigerant inventory of an operating safety-related chilled water train escapes, the resulting refrigerant concentration in the equipment room (which is outside the control room pressure envelope) is well within acceptable limits.

purge, the full 15,000 cfm is exhausted through the plant vent. The 40,000 cfm exhaust air flow of the Refueling Purge & Heating Subsystem first passes through a filter unit located in the CEVA 21′ -6" El. before discharging to the plant vent. These flows are adjusted by manual operation of balancing dampers.

The compliance of the containment pre-entry purge exhaust (filtered) System to the requirements of Regulatory Guide 1.140, Rev. 1, October 1979, is outlined in Table 9.4-23.

e. Control Rod Drive Mechanism Cooling Subsystem

A metal shroud surrounds the CRDMs for their full height to direct cooling air along the length of the CRDMs. Air is drawn in through four nozzles spaced around the CRDMs at the reactor vessel head interface, and up past the CRDMs. The air then exits the metal shroud at the top (see Figure 9.1-12).

Three cooling fans are provided. Two out of the three fans normally operate with the third fan in standby. Operation of any two fans will produce a cooling air flow rate equal to or greater than the design cooling air flow rate of 46,000 scfm, and average velocities across the CRDM coil stacks of 30-50 fps.

Operation of more or fewer than two fans is alarmed. Temperature sensors located in the air outlet flow path alarm low or high CRDM cooling air exit temperature. Higher than normal air temperature would indicate fewer than two fans operating, whereas low air temperature would indicate a failed open outlet backdraft damper or three fans in operation.

Even if all cooling capability were lost, the reactor could be tripped and safely shut down. The cooling function does not influence the safety of the CRDMs in their ability to trip the reactor when necessary.

The fans are controlled from the MCB with one fan powered from Train A and two from Train B. The fans and dampers are further described in Table 9.4-8.

In the event of a "P" signal, the fans will stop. These fans cannot be restarted by resetting the signals. Should a loss of offsite power occur, the previously operating fans will restart in accordance with the emergency power sequencer.
The CRDM cooling fans have no safety-related function and are non-seismic Category I.

f. RCA Tunnel Exhaust System

An exhaust register located approximately at elevation 36'-0" in the RCA walkway exhausts the air supplied to the RCA tunnel. A ductwork

9.4.15.1 Design Bases

a. The Turbine Building HVAC systems are designed to heat, ventilate, and air condition when and where necessary to maintain design temperature and humidity conditions.

b. The ventilation systems for the battery room located in the relay room, the main battery room and the radio room are designed to prevent hydrogen gas buildup.

c. The electronics work room, turbine erector's office, startup room, relay room and radio room are slightly pressurized over ambient to prevent dust from entering those areas.

d. Codes and standards applicable to the Turbine Building ventilation system equipment are listed in Table 9.4-1.

e. The ventilation system for the Lube Oil Storage Building is designed to prevent flammable vapor buildup.

9.4.15.2 System Description

The Turbine Building ventilation system is shown on Figure 9.4-24. There is no safety-related equipment associated with this system. Design data is presented in Table 9.4-19.

a. Turbine Hall and Heated Bay

The turbine hall and heater bay have a total of twenty power roof ventilators, ten for each area. Each area is further subdivided into ten ventilation zones with an operable louver and associated power roof ventilator. The operating louvers are located along the east and south walls of the turbine hall, divided between elevations 21'-0" and 46'-0"; ten louvers (eight of these are a double set) at the lower level and ten at the higher elevation. There are also eight additional movable louvers located at elevation 52'.

Air enters the building through the louvers and is circulated up through the upper floor elevations via floor gratings and openings. The air is then exhausted though the power roof ventilators. Equipment details are found in Table 9.4-19.

The louvers are operated by pneumatic actuators controlled by solenoid valves. The solenoid valves, in turn, are controlled through manual/automatic/close switches located at local control panels. When the louvers are in the full open position, the power roof ventilators will operate.

b. Turbine Erector's Office, Electronics Workroom and Startup Room

The turbine erector's office, electronics work room and startup room are air conditioned using a split system direct expansion multi-zone air conditioning, ventilating and heating unit with a remote condensing unit. Table 9.4-19 contains design data relating to this system. Figure 9.4-24 shows the air conditioning system.

The multi-zone unit is located in the roof of the area it serves, while the condensing unit is installed on the roof of the Turbine Building heater bay. The multi-zone unit consists of a mixing box with dampers, filter section, centrifugal fan, electric heating and refrigerant coils and a zone damper section.

The air-cooled condenser consists of a condensing coil and fans. This system is manually operated through a local control panel by placing the multi-zone unit switch in the "RUN" position, which causes the fan to run continuously. Individual space thermostats control the zone dampers to provide room temperature control. An enthalpy controller selects the operating mode of the condensing unit, as well as positions the mixing section dampers to allow natural cooling when possible. A minimum outside air position for the dampers permits ventilation air to be drawn in at all times. Whenever one or more of the space thermostats calls for heat, the cooling zone damper(s) will close as the heating zone damper(s) open. If the space thermostat is not satisfied, then the electric heating coil is actuated.

An exhaust fan located in the toilet room exhausts the minimum ventilation air outside the building. A pressure relief damper, located in the electronic work room, prevents excessive pressure in the area.

Self-contained room air conditioning units are provided in Room T-300, T-307 and T-308 as back-ups in the event that 1-TAH-AC-34 is out of service.

c. Relay Room

The relay room has battery rooms associated with it. Table 9.4-19 lists the design data which relates to this system; Figure 9.4-24 diagrams the air conditioning system.

A conventional split system air conditioning arrangement provides heating, cooling and ventilation for the area, including the battery rooms. The air handling unit consists of a mixing damper section, filter section, electric heating coil, refrigerant coils and a fan section. The air handling unit is located on the roof of the relay room.

A remote mounted condensing unit, consisting of a condensing coil and fan, is located on the Administration and Service Building roof.

TABLE 9.4-1

CODES AND STANDARDS FOR HVAC SYSTEM COMPONENTS

	Design	Fabrication
Fans	AMCA MFG	AMCA MFG SSPC
Fan Motors	NEMA ANSI	NEMA ANSI
Filters	ASHRAE	MFG
Filter Motors	NEMA ANSI	NEMA ANSI
Heating Coils	ARI	None
Cooling Coils	ARI ASME Section III	ASME Section III
Pumps	HI ANSI AFBMA	MFG
Heat Exchangers	ASME	ASME
Unit Heaters	AMCA	MFG
Controls	IEEE (Safety System only)	None
Liquid Chillers	ASME NEMA ASHRAE ARI MFG	ASME NEMA ASHRAE ARI MFG
Backdraft Dampers	MFG	MFG

The acronyms listed in this table are identified below:

ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
AFBMA - Anti-Friction Bearing Manufacturers Association
AMCA - Air Moving and Conditioning Association
SSPC - Steel Structures Painting Council
NEMA - National Electrical Manufacturers Association
ANSI - American National Standards Institute
IEEE - Institute of Electrical and Electronic Engineers
ARI - Air Conditioning and Refrigeration Institute
AISI - American Iron and Steel Institute
ASME - American Society of Mechanical Engineers
MFG - Manufacturer's Standards
HI - Hydraulic Institute

TABLE 9.4-1A
(Sheet 1 of 2)

GUIDELINES, CODES AND STANDARDS FOR HVAC DIGITAL CONTROL UPGRADE

1. Regulatory Guide 1.152, "Criteria for Programmable Digital Computer System Software in Safety-Related Systems of Nuclear Power Plants"

2. Regulatory Guide 1.153, "Criteria for Power, Instrumentation and Control Portions of Safety Systems"

3. Generic Letter 91-05, "Licensee Commercial Grade Procurement and Dedication"

4. Generic Letter 95-02, "Use of NUMARC/EPRI Report TR-102348, 'Guidelines on Licensing Digital Upgrades,' in Determining the Acceptability of Performing Analog to Digital Replacements Under 10 CFR 50.59"

5. IEEE 7-4.3.2-1993, "IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations"

6. IEEE 1012-1986, "IEEE Standard for Software Verification and Validation Plans"

7. IEEE 1028-1988, "IEEE Standard for Software Review and Audits"

8. IEEE 730-1989, "Software Quality Assurance Plans"

9. IEEE 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations"

10. IEEE 323-1974, "Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations"

11. IEEE 344-1975, "Guide for Seismic Qualification of Class 1E Electric Equipment for Nuclear Power Generating Stations"

12. IEC QP-055010-2, "Software and Computers in the Safety Systems of Nuclear Power Stations"

13. EPRI TR-102348, "Guidelines for Licensing of Digital Upgrades"

14. EPRI TR-102323, "Guideline for Electromagnetic Interference Testing in Power Plants"

15. EPRI TR-106439, "Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications"

TABLE 9.4-1A
(Sheet 2 of 2)

GUIDELINES, CODES AND STANDARDS FOR HVAC DIGITAL CONTROL UPGRADE

16. EPRI NP-5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications"

17. ASME NQA-1A-1995, Appendix 7A-2, "Non-mandatory Guideline for Commercial Grade Items"

18. ASME NQA-2A-1990 Addenda, Part 2.7 - "Quality Assurance Requirements of Computer Software for Nuclear Facility Applications"

TABLE 9.4-2
(Sheet 1 of 3)

PRIMARY AUXILIARY BUILDING HVAC COMPONENT SYSTEM PERFORMANCE INFORMATION

Equipment	Supply System	Exhaust System (Non-Filtered)	PCCW & Boron Injection Pump Area	Filter Room	Boric Acid Tank Area
Fans					
Type	Centrifugal	Centrifugal	Vane Axial	Power Roof Ventilator	
Seismic Category I	No	No	Yes	No	
Safety Class	None	None	3	None	
Number	3 (2 operating, 1 standby)	3 (2 operating, 1 standby)	2	2	
Air Quantity/Fan (cfm)	55,590	21,670	10,000	4,000	
Drive	"V" Belt	"V" Belt	Direct	Direct	
Class 1E	No	No	Yes	No	
Isolation Dampers					
Type	Parallel Blade	Parallel Blade			
Number	2 (in series)	2 (in series)			
Seismic Category I	Yes	Yes			
Safety Class	3	3			
Air Quantity (cfm)	23,400	23,400			
Operation	Automatic	Automatic			
Actuator	Pneumatic	Pneumatic			

TABLE 9.4-8
(Sheet 1 of 2)

CONTAINMENT STRUCTURE HVAC SYSTEM DESIGN AND PERFORMANCE DATA

Equipment	Containment Air Purge Systems: Containment Pre-Entry Purge Subsystem	Containment Air Purge Systems: Containment Refueling Purge & Heating Subsystem	Containment Online Purge System	Containment Structure Cooling Units	Control Rod Drive Mechanism Cooling Subsystem	Containment Structure Recirculating Filter System
Fans						
Type	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Vane Axial	Vane Axial
Quantity	2 (1 supply, 1 exhaust)	2 (1 supply, 1 exhaust)	1	6 (5 operating, 1 standby)	3 (2 operating, 1 standby)	2 (1 operating; 1 standby)
Design Air Flow Rate/Fan (cu. ft/min)	11,000 Supply *15,000 Exhaust	40,000	1,000	56,000	25,000	4,000
Drive	"V" Belt	"V" Belt	Direct	Direct	Direct	Direct
Air Cleaning Unit		N/A	N/A	N/A	N/A	Packaged, consisting of prefilter, HEPA filter and carbon adsorber trays
Type	Packaged, consisting of prefilter, HEPA filter and carbon adsorber bed.	Packaged, consisting of prefilter and HEPA filter	Note: Exhaust through PAB normal exhaust air cleaning unit.			
Quantity						
Prefilter	12-24x24x12	25-24x24x2				3-24x24x12
HEPA	12-24x24x12	25-24x24x12				3-24x24x12
Carbon Adsorber	6-4" deep carbon beds (2,500 cfm each)					12-2" deep carbon beds
Efficiency						
Prefilter		60% (ASHRAE 52-58)				60% (ASHRAE 52-58)
HEPA		99.97% for elemental 3 micron particles				99.97% 3 micron particles)
Carbon Adsorber	99.9% for elemental iodine 99.5% for methyl iodine					99.9% for elemental iodine 99.5% for methyl iodine

* Includes 4000 cfm exhaust from RCA tunnel.

TABLE 9.4-8
(Sheet 2 of 2)

CONTAINMENT STRUCTURE HVAC SYSTEM DESIGN AND PERFORMANCE DATA

Equipment	Containment Air Purge Systems: Containment Pre-Entry Purge Subsystem	Containment Air Purge Systems: Containment Refueling Purge & Heating Subsystem	Containment Online Purge System	Containment Structure Cooling Units	Control Rod Drive Mechanism Cooling Subsystem	Containment Structure Recirculating Filter System
Media						
Prefilter		Fiberous glass, UL Class 1				Fiberous glass, UL Class 1
HEPA		Glass per MIL-F-51079 as called for in MIL-F-51068				Glass per MIL-F-51079 as called for in MIL-F-51068
Carbon Adsorber	4" deep beds of activated carbon					4" deep beds of activated carbon
Dampers						
Type	Automatic	Automatic	Backdraft	Backdraft	Backdraft	Automatic
Quantity	(1 supply, 1 exhaust)	(1 supply, 1 exhaust)	(1 supply only)	6 (1 each unit)	3 (1 each unit)	4 (2 each fan)
Operator	Pneumatic	Pneumatic	None	None	None	Pneumatic

TABLE 9.4-17
(Sheet 1 of 4)

CONTROL ROOM COMPLEX AIR CONDITIONING
SYSTEM PERFORMANCE INFORMATION

Equipment	Trains A & B
Control Room Air Conditioning Unit	
Type	Horizontal, draw-thru consisting of a fan section, cooling coil section and filter section
Quantity	2
Seismic Category	I - all components
Safety Class	3 - all components except filter
Fans	Centrifugal, nonoverloading with backward curved blades
Quantity	1 (per AC unit)
Air Flow Rate (cfm)	25,700
Drive	"V" Belt
Class 1E	Yes
Filter	
Type	Disposable, flat filter with micro glass media
Size	Nominal 20" x 25" x 2" thick
Quantity	15 (per AC unit)
Efficiency	>75% dust arrestance per ASHRAE 52.1-1992
Chillers	
Type	Air cooled, scroll
Safety Class	3
Seismic Category	I
Quantity	1 (per Train)
Cooling Capacity, tons	62.2
Cooling Medium	Ethylene glycol/water(35-40% by volume)
Refrigerant	R22

TABLE 9.4-17
(Sheet 2 of 4)

CONTROL ROOM COMPLEX AIR CONDITIONING
SYSTEM PERFORMANCE INFORMATION

Equipment	Trains A & B
Cooling Coils	
Type	Chilled water, aluminum fins, copper tubes
Safety Class	3
Seismic Category	I
Quantity	1 (per Train)
Cooling Medium	Ethylene glycol/water(35-40% by volume)
Cooling Capacity, btu/hr	704,300
Pumps	
Type	Centrifugal
Safety Class	3
Seismic Category	I
Quantity	2 (per Train)
Water Flow Rate, gpm	170
Total Developed Head (Ft. of water)	150
Pump RPM	3500
Motor HP	15
Motor RPM	3600
Expansion Tank	
Type	Horizontal, steel, ASME Section VIII
Safety Class	3
Seismic Category	I
Quantity	1 (per Train)
Volume, gal	60
Temperature Control Valve	
Type	3-way, diverting (bypass)
Safety Class	3
Seismic Category	I
Quantity	1 (per Train)
Actuator	Electric, 120 VAC
Controller	2-12 vdc

TABLE 9.4-17
(Sheet 3 of 4)

CONTROL ROOM COMPLEX AIR CONDITIONING
SYSTEM PERFORMANCE INFORMATION

Equipment	Trains A & B
Chiller Condenser Exhaust Fans	
Type	Vaneaxial
Safety Class	3
Seismic Category	I
Quantity	1 (per Train)
Air Flow Rate, cfm	40,700
Pressure Drop (Inches water gauge)	2.97
Fan Brakehorsepower BHP	31
Motor HP	40
Motor RPM	1750
Computer Room Air Conditioning Unit	
Type	Vertical, floor mounted, consisting of a fan section, cooling coil section and filter section
Quantity	1
Seismic Category	None
Safety Class	None
Fans	Centrifugal, nonoverloading with backward curved blades
Quantity	1 (per AC unit)
Air Flow Rate (cfm)	10,400
Drive	"V" Belt
Class 1E	No
Coil	
Type	Direct expansion, aluminum fin, copper tube
Quantity	1 (per AC unit)
Cooling Capacity (Btu/hr)	130,193
Filter	
Type	Disposable, high velocity
Quantity	6
Size	16"x25"x2" thick
Efficiency	30-35% per ASHRAE std. 52-68

TABLE 9.4-17
(Sheet 4 of 4)

CONTROL ROOM COMPLEX AIR CONDITIONING
SYSTEM PERFORMANCE INFORMATION

Equipment	Trains A & B
Computer Room Condensing Unit	
Type	Vertical, draw-thru
Quantity	2
Safety Class	None
Seismic Category	None
Fans	
Type	Four bladed aluminum propeller
Quantity	2 (per condensing unit)
Air Flow Rate (cfm)	4,000 (per fan)
Drive	Direct
Class 1E	No
Coil	
Type	Direct expansion, aluminum fin, copper tube
Quantity	1 (per condensing unit)
Capacity (Btu/hr)	130,193
Compressor	
Type	Semi-hermetic
Quantity	1 (per condensing unit)
Refrigeration Effect (Btu/hr)	130,193
Class 1E Motor	No
Accessories	Crankcase heater
Unit Heaters	
Type	Electric, propeller fan
Quantity	6
Heating Capacity (KW/unit)	23
Safety Class	No

TABLE 9.4-17a
(Sheet 1 of 1)

CONTROL ROOM COMPLEX AIR CONDITIONING
DESIGN AND PERFORMANCE INFORMATION - NON-SAFETY RELATED SYSTEM

Chillers	
Type	Air cooled, reciprocating
Quantity	2
Cooling Capacity, tons	38
Cooling Medium	Ethylene glycol/water
Refrigerant	R22
Cooling Coils	
Type	Chilled water, aluminum fins, copper tubes
Quantity	1 (per AC unit)
Cooling Medium	Ethylene glycol/water
Cooling Capacity, Btu/hr	704,000
Seismic Category	1
Safety Class	3
Pumps	
Type	Centrifugal
Water Flow Rate, gpm	100
Pump RPM	1750
Motor HP	10
Motor RPM	1800
Expansion Tank	
Type	Vertical, carbon steel, ASME Section VIII
Quantity	1
Volume, gal	120
Diaphragm	Butyl, 12 psi precharge with air
Air Separator	
Type	In-line, carbon steel, ASME Section VIII
Quantity	1
Size, in	4
Temperature Control Valve	
Type	3 way, diverting
Quantity	1
Actuator	Electric, 120VAC
Control	4-20 madc

TABLE 9.4-19
(Sheet 3 of 3)

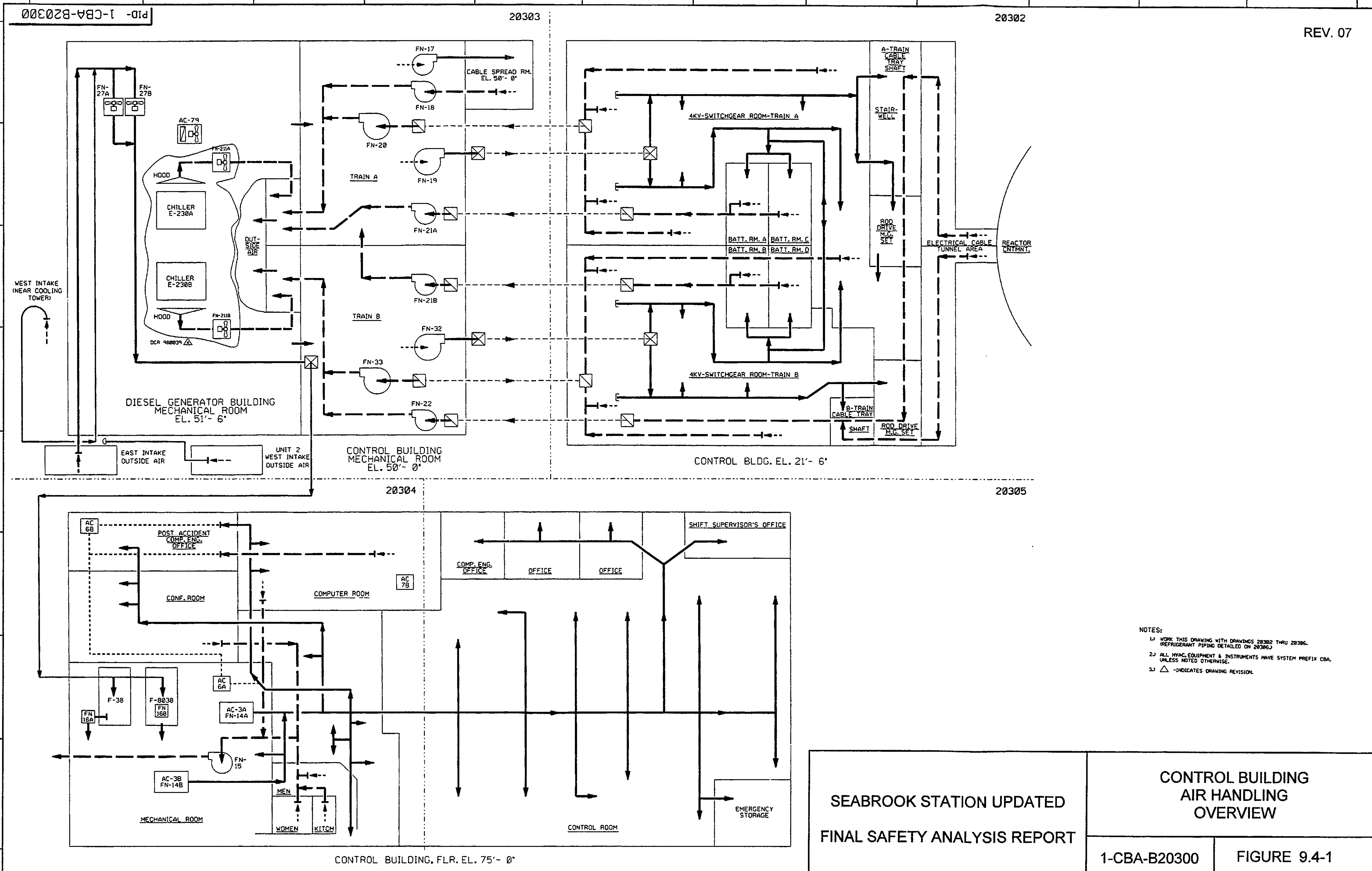
TURBINE BUILDING HVAC DESIGN AND PERFORMANCE DATA

Equipment	Turbine Hall	Heater Bay	Battery Room	Relay Room		Turbine Erectors's Office Electronics Work Room and Startup Room		Elevator Machinery Room	Turbine Lube Oil Tank Room	Feed Pump & Turbine RMS (North and South)	Lube Oil Storage Building
				Relay Room	Battery Room		Toilet Room				
Heating Capacity (Btu/hr.)				2" fibrous glass		2" fibrous glass					
Filter Type Efficiency				10% ASHRAE average atmospheric		10% ASHRAE average atmospheric					
Zone Dampers Type						Proportioning					
No. of Zones						3					
Actuator						Pneumatic Modulating					
Equipment Dampers											
Type	Parallel multiblade exhaust	Parallel multiblade exhaust		Parallel multiblade		Parallel multi-blade		Parallel multiblade exhaust	Parallel multiblade exhaust		3-hr vertical fire
Quantity	10	10		2		2		1	1		1
Actuator	Motor	Motor		Pneumatic modulating		Pneumatic modulating					
Size Outside & Return Air				19½x70"		19½x62"					
Exhaust Dampers											
Type			Parallel multiblade backdraft	Proportion-ing multi-blade	Parallel multiblade backdraft		None			Parallel multiblade exhaust	3-hr vertical fire
Quantity			1	1	2					2	4
Louvers Type	Movable	Movable	Fixed								
Quantity	10	10	1								
Intake/Exhaust Louvers Type	Movable										
Quantity	8										

TABLE 9.4-20
(Sheet 1 of 4)

COMPLIANCE OF PRIMARY AUXILIARY BUILDING
NORMAL EXHAUST FILTRATION SYSTEM TO
REGULATORY GUIDE 1.140, REV. 1 - OCTOBER 1979

Regulatory Guide Section	Applicability To This System	Comment Index
C.1.a	Yes	----
C.1.b	Yes	Note 1
C.1.c	Yes	----
C.1.d	Yes	----
C.2.a	Yes	----
C.2.b	Yes	Note 2
C.2.c	Yes	Note 3
C.2.d	Yes	----
C.2.e	Yes	----
C.2.f	Yes	Note 4
C.3.a	Yes	Note 5
C.3.b	Yes	----
C.3.c	Yes	Note 7
C.3.d	Yes	Note 8
C.3.e	Yes	Note 9
C.3.f	Yes	Note 10
C.3.g	Yes	Note 11
C.3.h	Yes	----
C.3.i	Yes	Note 12
C.3.j	Yes	----
C.3.k	Yes	----
C.3.l	Yes	Note 13
C.3.m	Yes	----
C.4.a	Yes	Note 14
C.4.b	Yes	Note 15
C.4.c	Yes	Note 16
C.4.d	Yes	----
C.5.a	Yes	Note 6
C.5.b	Yes	Note 6
C.5.c	Yes	Note 6 & 18
C.5.d	Yes	Note 6 & 18
C.6.a	Yes	Note 7
C.6.b	Yes	Note 7



NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20302 THRU 20306. (REFRIGERANT PIPING DETAILED ON 20306.)
2. ALL HVAC EQUIPMENT & INSTRUMENTS HAVE SYSTEM PREFIX CBA, UNLESS NOTED OTHERWISE.
3. △ -INDICATES DRAWING REVISION.

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT

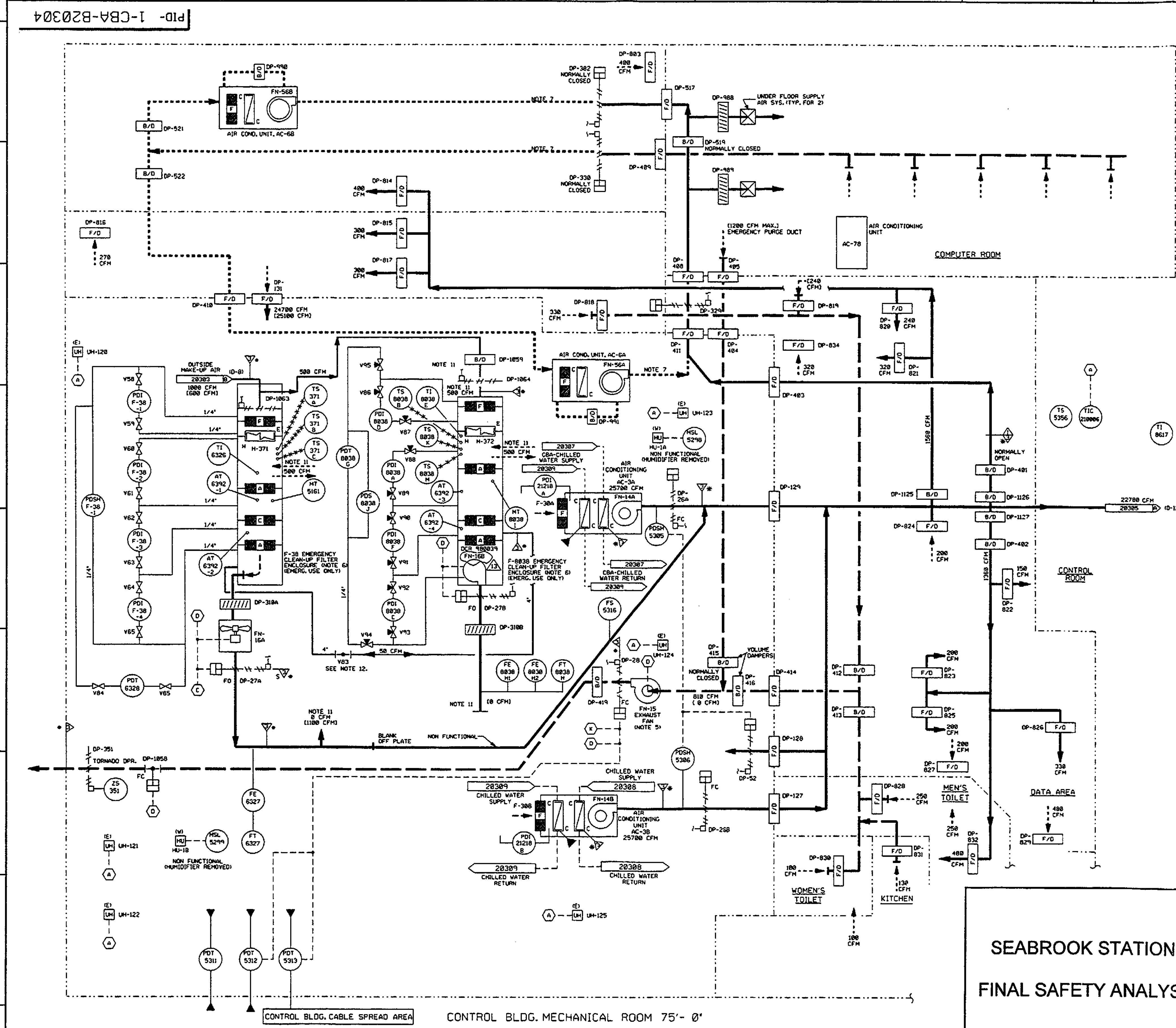
CONTROL BUILDING AIR HANDLING OVERVIEW

1-CBA-B20300

FIGURE 9.4-1

04/05/00 REV. 04

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20300, 20302, 20303, 20305 & 20306.
2. ALL HVAC, EQUIPMENT & INSTRUMENTS HAVE SYSTEM PREFIX "CBA". UNLESS NOTED OTHERWISE.
3. FOR SYMBOL LEGEND SEE DRAWING 20302.
4. INSTRUMENT REFERENCES:
   - (A) TIE-IN FOR UNIT HEATERS UH-120 THRU UH-125 & TISL-5357 ON THIS DRAWING.
   - (C) SAFETY INJECTION SIGNAL "SI"
   - (D) INTERLOCK WITH FILTER RECIRC. SIGNAL. LOGIC DIAGRAM 503231.
   - (K) TO PDIS-5332 ON DRAWING 20303
5. EXHAUST FAN FN-15 & DAMPER DP-28 IS SIZED FOR 1200 CFM CONSIDERING THE WORST POSSIBLE CASE OF ZERO CFM EXFILTRATION.
6. FILTER DIFFERENTIAL PRESSURE & REQUIRED FLOWS:

FILTER TAG NO.	CLEAN FLOW CFM	DIRTY FLOW CFM	ANSI DIRTY FLOW CFM	SURVEILLANCE TEST FLOW CFM	SURVEILLANCE TEST FLOW +10% CFM	SURVEILLANCE TEST FLOW -10% CFM
CBA-F-38	1210	1100	990	1100	1210	990
CBA-F-8038	1210	1100	990	1100	1210	990

7. AC-6A & B USED ONLY AS EMERGENCY BACK-UP. NORMALLY ABANDONED.
8. DELELTED
9. DELETED
10. △ INDICATES REVISION LEVEL
11. REQUIRED FLOW DISTRIBUTION BASED ON CLEAN TO ANSI DIRTY FILTER CONDITIONS, WITH SINGLE TRAIN OPERATION IN CFM:

FAN TAG NUMBER	FILTER TAG NUMBER	EMERGENCY TOTAL=1100 ± 10%	
		MAKE-UP	RECIRC
CBA-FN-16A	CBA-F-38	540 TO 600	390 TO 610 COMBINED
	CBA-F-8038	0	
CBA-FN-16B	CBA-F-38	0	390 TO 610 COMBINED
	CBA-F-8038	540 TO 600	

FAN TAG NUMBER	FILTER TAG NUMBER	NORMAL MAKE-UP TOTAL= 1000 ± 10%
CBA-FN-27A	CBA-F-38	500 ± 10%
	CBA-F-8038	500 ± 10%
CBA-FN-27B	CBA-F-38	500 ± 10%
	CBA-F-8038	500 ± 10%

12. 1-CBA-V-83 WILL BE NORMALLY OPEN/THROTTLED TO A PRESET POSITION.
13. DELETED
14. DELETED

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED

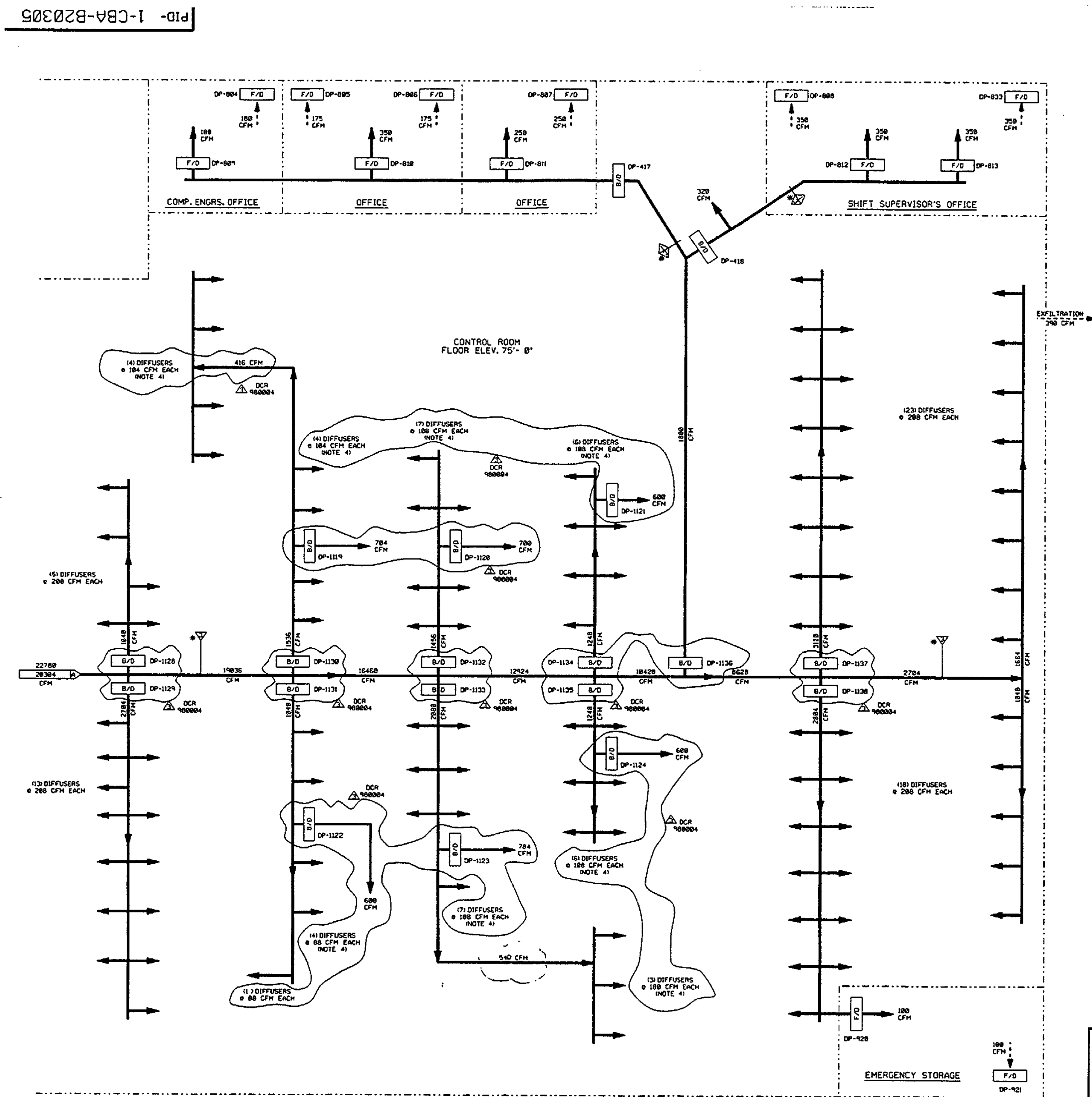
FINAL SAFETY ANALYSIS REPORT

CONTROL BUILDING AIR HANDLING MECHANICAL ROOM ELEVATION 75'-0" DETAIL

1-CBA-B20304

FIGURE 9.4-2

REV. 07



NOTES:

1.) WORK THIS DRAWING WITH B20300, B20302 THRU B20304 & B20306.

2.) ALL HVAC, EQUIPMENT & INSTRUMENTS HAVE SYSTEM PREFIX 'CBA', UNLESS NOTED OTHERWISE.

3.) FOR SYMBOL LEGEND SEE DRAWING B20302.

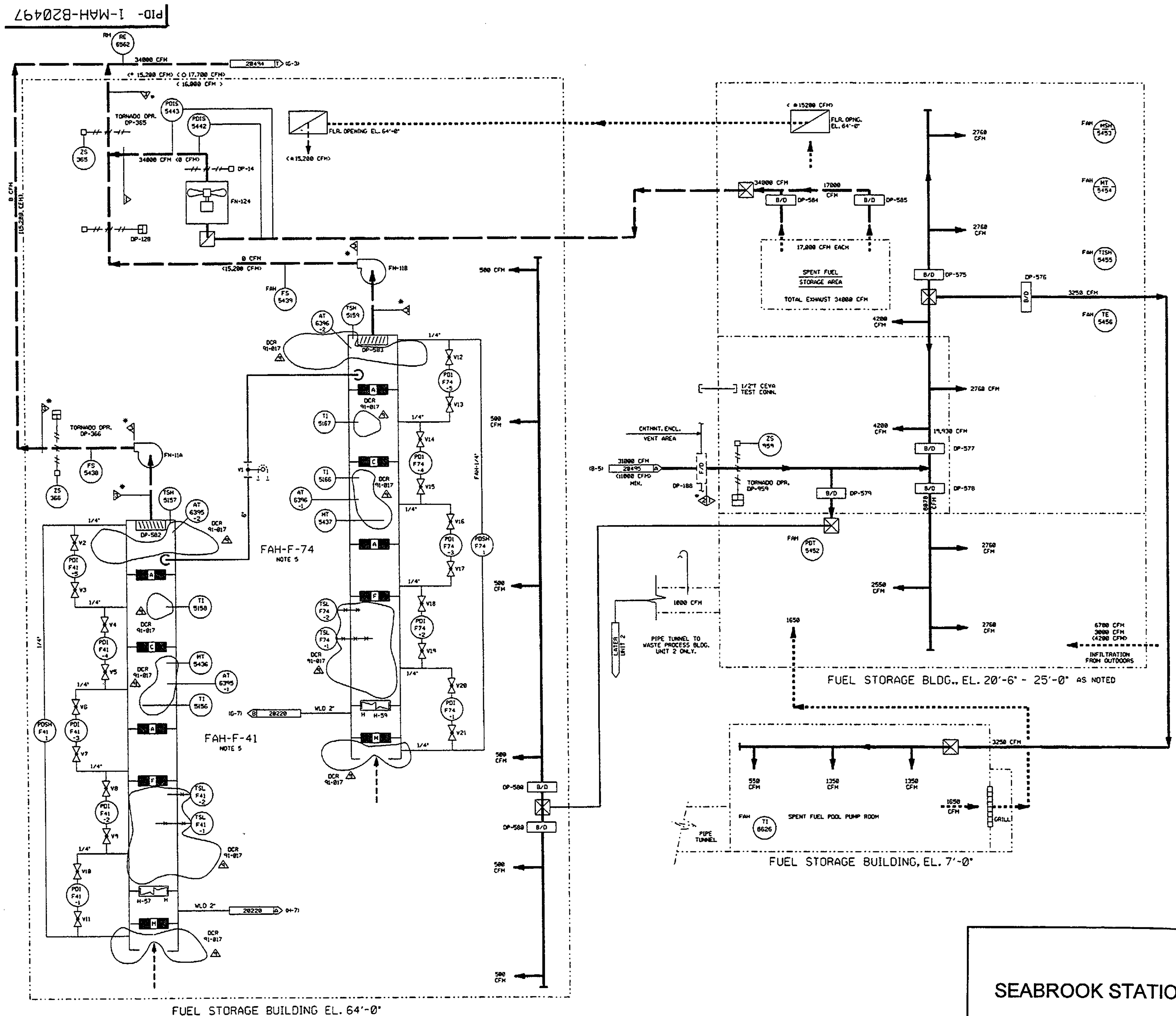
4.) FLOW DISTRIBUTION TO EACH DIFFUSER IS NOT CRITICAL, PROVIDED THAT THE OVERALL BRANCH FLOW IS WITHIN ±10% OF SPECIFIED FLOW.

DCR 980004

PORTIONS OF THIS DRAWING ARE **NUCLEAR SAFETY RELATED**

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	CONTROL BUILDING AIR HANDLING CONTROL ROOM DETAIL
	1-CBA-B20305 / FIGURE 9.4-3

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES :

1. WORK THIS DRAWING WITH 20492, 20494 THRU 20496 & 20498 THRU 20500.
2. ALL HVAC, EQUIP, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX FAH (FUEL STORAGE BLDG. AIR HANDLING), UNLESS NOTED.
3. FOR SYMBOL LEGEND, SEE NOTE 3 ON DRAWING 20494.
4. [1]▷ ALL DUCTWORK, UNLESS NOTED.
5. FILTER HOUSING DIFFERENTIAL PRESS & REQUIRED FLOWS :

FILTER TAG NO.	CLEAN FLOW CFM	DIRTY FLOW CFM	ANSI DIRTY FLOW CFM	SURVEILLANCE TEST FLOW CFM	SURVEILLANCE TEST FLOW +10% CFM	SURVEILLANCE TEST FLOW +10% CFM
FAH-F-41	17700	16000	15200	16450	18095	14805
FAH-F-74	17700	16000	15200	16450	18095	14805

6. △ INDICATES REVISION LEVEL.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

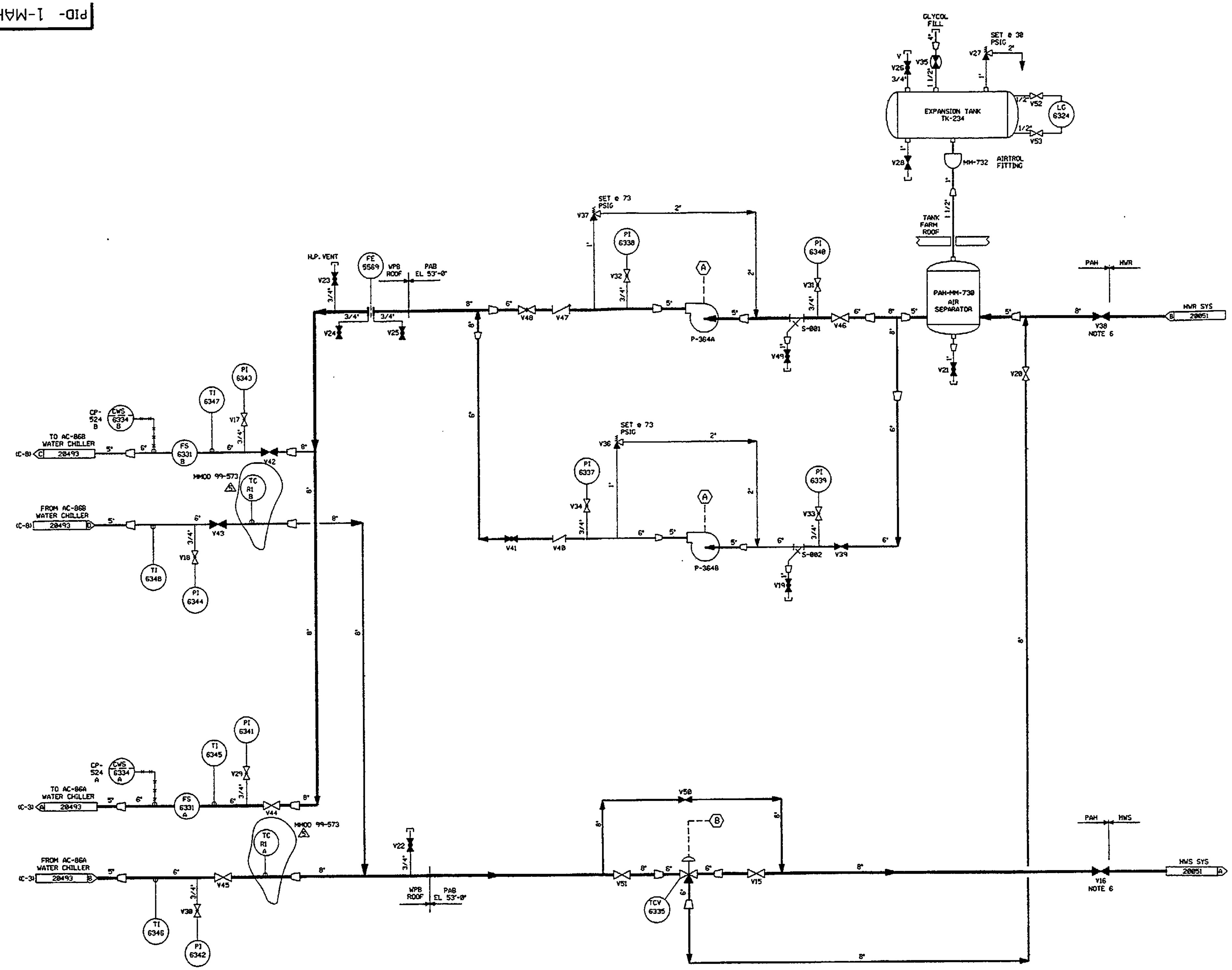
SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	MISCELLANEOUS AIR HANDLING FUEL STORAGE BUILDING DETAIL
	1-MAH-B20497 / FIGURE 9.4-4

02/04/00 REV. 09

PID- 1-MAH-B20507

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



NOTES:

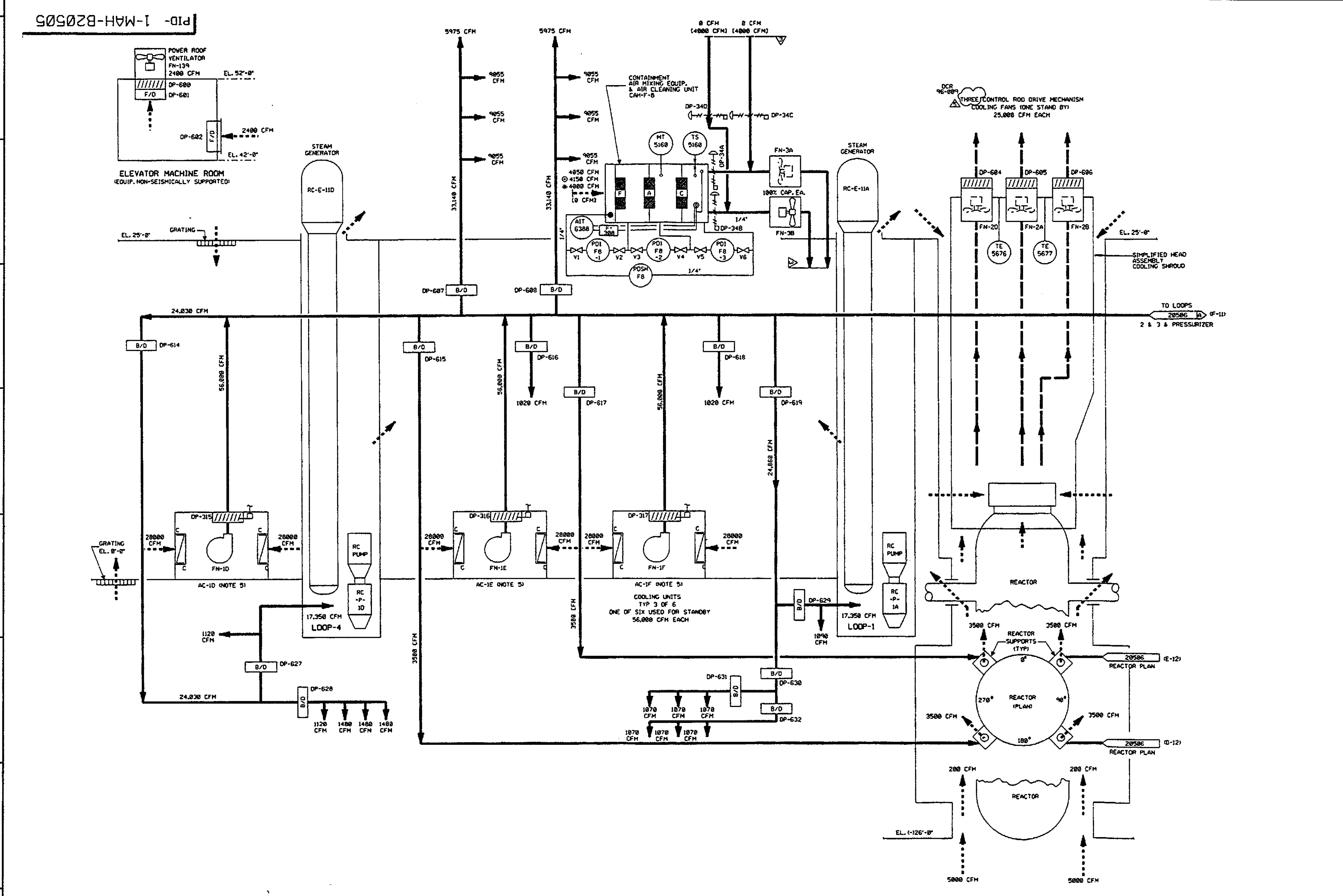
1. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX PAH UNLESS NOTED.
2. WORK THIS DRAWING WITH DRAWINGS 20492, 20493 AND 20494 THRU 20506 & 20508.
3. NORMALLY ONE PUMP AND ONE CHILLER OPERATE AT A TIME. THE OTHER PUMP AND CHILLER SERVE AS STANDBY EQUIPMENT.
4. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS, UNLESS NOTED OTHERWISE.
5. CHILLED WATER CONSISTS OF WATER WITH 40% GLYCOL (BY WEIGHT) ADDED FOR FREEZE PROTECTION.
6. VALVES NORMALLY CLOSED, USED FOR SUMMER OPERATION ONLY.
7. △ - INDICATES REVISION LEVEL.

8. INSTRUMENT REFERENCES:
   (A) FROM CP-507
   (B) FROM TIC-6335 ON DWG 20494

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	MISCELLANEOUS AIR HANDLING PAB CHILLED WATER SYSTEM	
	1-MAH-B20507	FIGURE 9.4-9 SH 2

07/24/00 REV. 05

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1). WORK THIS DWG WITH DWGS 20492, 20494 THRU 20504 & 20506.

2). ALL HVAC. EQUIPMENT, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX CAH (CONTAINMENT AIR HANDLING) UNLESS NOTED.

3). FOR SYMBOL LEGEND, SEE NOTE 3 ON DWG 20494.

4). ALL DUCT WORK UNLESS NOTED.

5). COMPONENT COOLING (CC) FOR THE COOLING COILS IN THE AIR CONDITIONING UNITS ARE AS FOLLOWS:
CAH-AC-1D - 1-CC-20214
CAH-AC-1E - 1-CC-20208
CAH-AC-1F - 1-CC-20207

6). FILTER DIFFERENTIAL PRESSURE AND REQUIRED FLOWS:

FILTER TAG NO.	CLEAN FLOW CFM	DIRTY FLOW CFM	ANSI DIRTY FLOW CFM	SURVEILLANCE TEST FLOW CFM	SURVEILLANCE TEST FLOW +10% CFM	SURVEILLANCE TEST FLOW -10% CFM
CAH-F-8	4150	4050	4000	4075	4482	3668

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

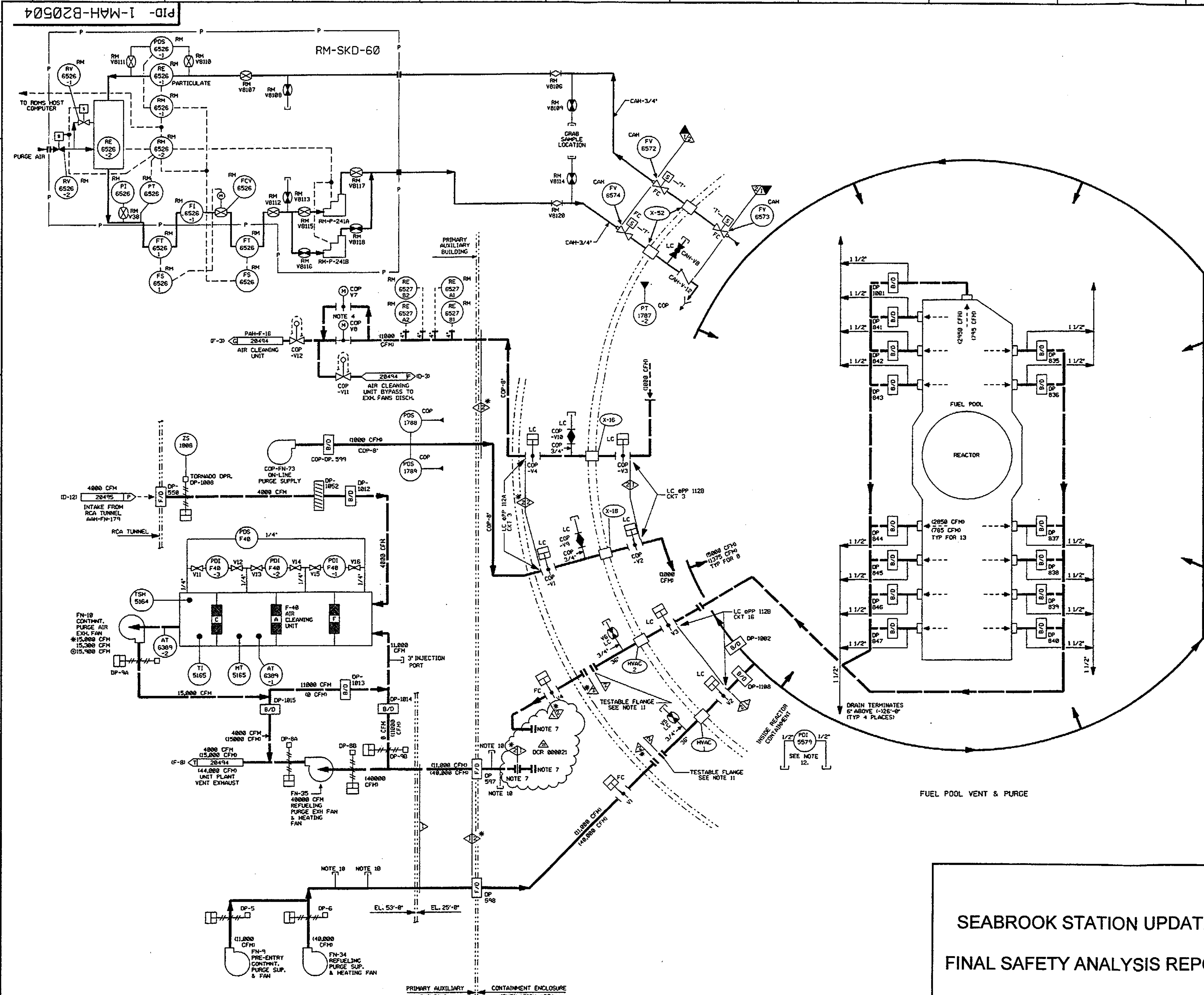
MISCELLANEOUS AIR HANDLING CONTAINMENT STRUCTURE DETAIL

1-MAH-B20505

FIGURE 9.4-13 SH 1

05/26/00 REV. 05

REV. 07



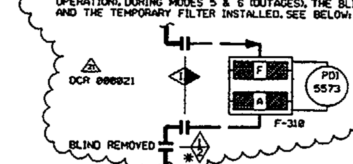
FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH 20492, 20494 THRU 20503; & 20505 & 20506.
2. ALL PIPING, HVAC, EQUIP, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX CAP (CONTAINMENT AIR PURGE) UNLESS NOTED.
   COP - (CONTAINMENT ON-LINE PURGE)
3. FOR SYMBOL LEGEND, SEE NOTE 3 ON DWG. 20494.
4. VALVE COP-V7 IS USED FOR THROTTLING.
5. FILTER HOUSING DIFFERENTIAL PRESSURES & REQUIRED FLOWS:

FILTER TAG NO.	CLEAN FLOW CFM	DIRTY FLOW CFM	ANSI DIRTY FLOW CFM	SURVEILLANCE TEST FLOW CFM	SURVEILLANCE TEST FLOW +10% CFM	SURVEILLANCE TEST FLOW -10% CFM
CAP-F-40	15900	15300	15000	15450	16995	13905

6. VENT & DRAIN CODE BREAKS ARE AT THE DOWNSTREAM SIDE OF THE OUTER ISOLATION VALVE PER 1-NHY-805111 UNLESS OTHERWISE NOTED.
7. BLINDS ARE INSTALLED TO ISOLATE THE FILTER. DURING MODES 1-4 (NORMAL OPERATION). DURING MODES 5 & 6 (OUTAGES), THE BLINDS WILL BE REMOVED AND THE TEMPORARY FILTER INSTALLED. SEE BELOW:



8. △ INDICATES REVISION LEVEL
9. DELETED
10. INSTRUMENT REMOVED AND LINE CAPPED.
11. TESTABLE FLANGES ARE INSTALLED DURING MODES 1-4 (NORMAL OPERATION). DURING MODES 5 & 6 (OUTAGES). THE BLIND FLANGES WILL BE REMOVED AND TRANSITION PIECES INSTALLED.
12. PDI FOR USE DURING REFUELING OUTAGES. ATTACH TEMP. TUBING TO HIGH SIDE AND ROUTE TO OUTSIDE AMBIENT.

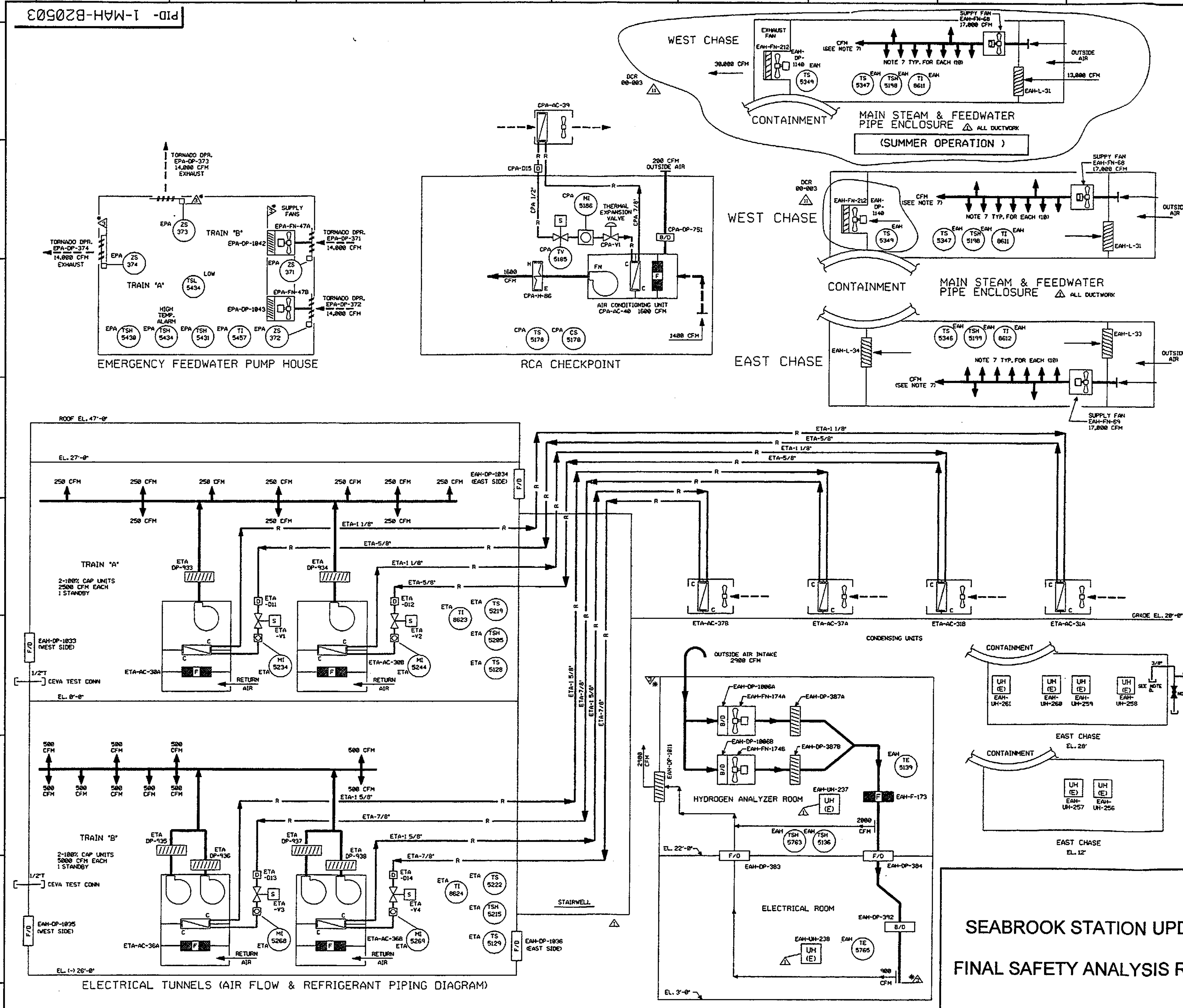
PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	MISCELLANEOUS AIR HANDLING CONTAINMENT & PURGES DETAIL (COP, CAP)
1-MAH-B20504	FIGURE 9.4-14

PID- 1-MAH-B20503

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DRAWING WITH DRAWINGS 20492, 20494 THRU 20502 & 20504 THRU 20508.
2. SYSTEM PREFIXES:
   - ETA - ELECTRICAL TUNNEL AIR HANDLING
   - EAH - CONTAINMENT ENCLOSURE AIR HANDLING
   - CPA - CHECK POINT AIR
   - EPA - EMERGENCY FEEDWATER PUMP BUILDING AIR HANDLING.
3. FOR SYMBOL LEGEND, SEE NOTE 3 ON DWG MAH 20494.
4. △ ALL DUCTWORK, UNLESS NOTED.
5. DELETED
6. △ INDICATES REVISION LEVEL
7. THE SYSTEM AIR FLOW RATE HAS BEEN ROUNDED TO 17,000 CFM. REGISTERS HAVE BEEN SET IN THE FULL OPEN POSITION WITH THE SPLITTER DAMPER SET SO THAT 2750 CFM EXITS THE REGISTERS NEAREST THE FANS.
8. ⅜" TUBE, PIPE SPEC. 2508, USED FOR NITROGEN BOTTLE CHARGING OF MSIV'S AND FWIV'S

PORTIONS OF THIS DRAWING ARE

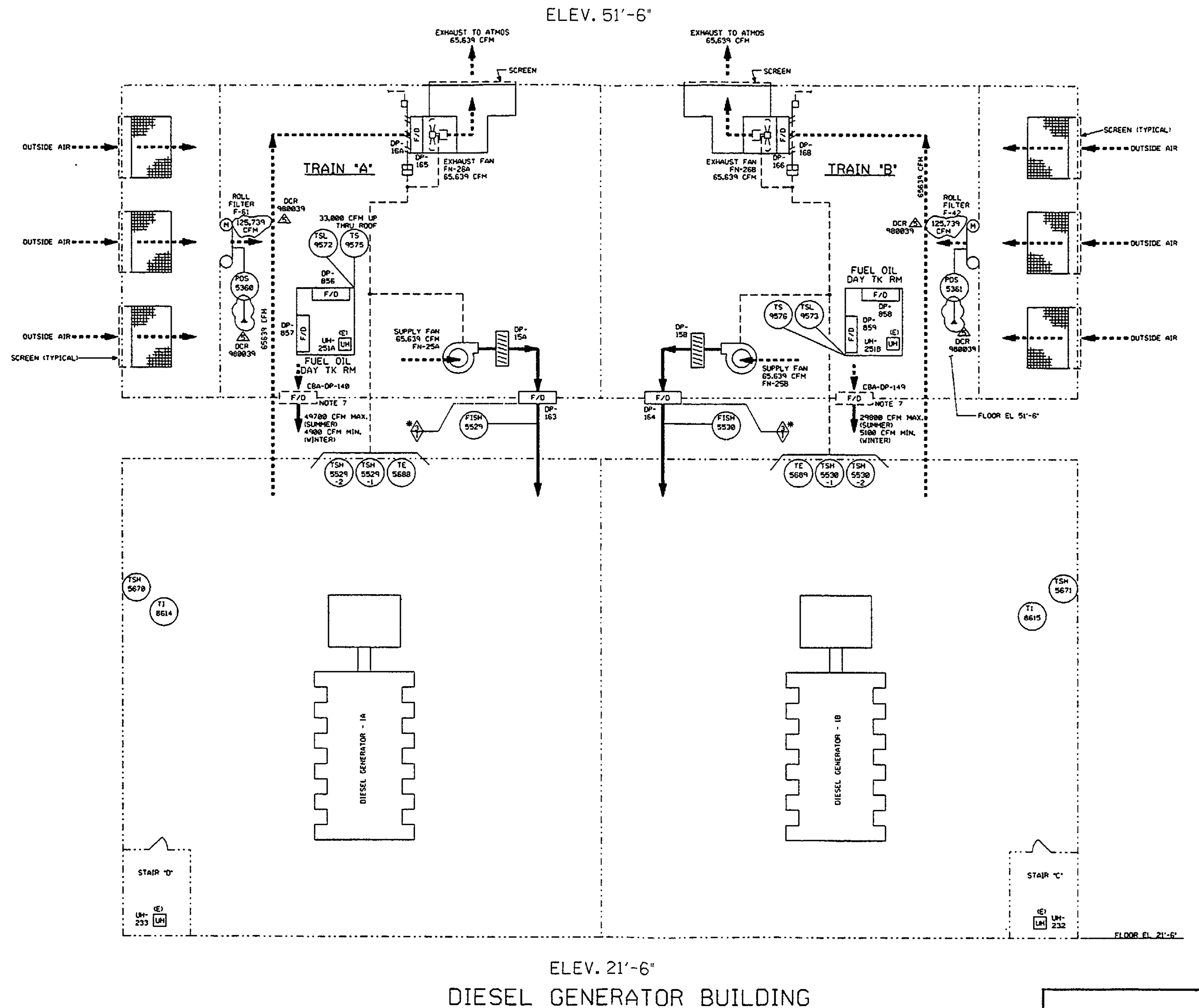
NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	MISCELLANEOUS AIR HANDLING DETAILS	
	1-MAH-B20503	FIGURE 9.4-15

11/14/00 REV. 11

PID- 1-DAH-B20624

REV. 07



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

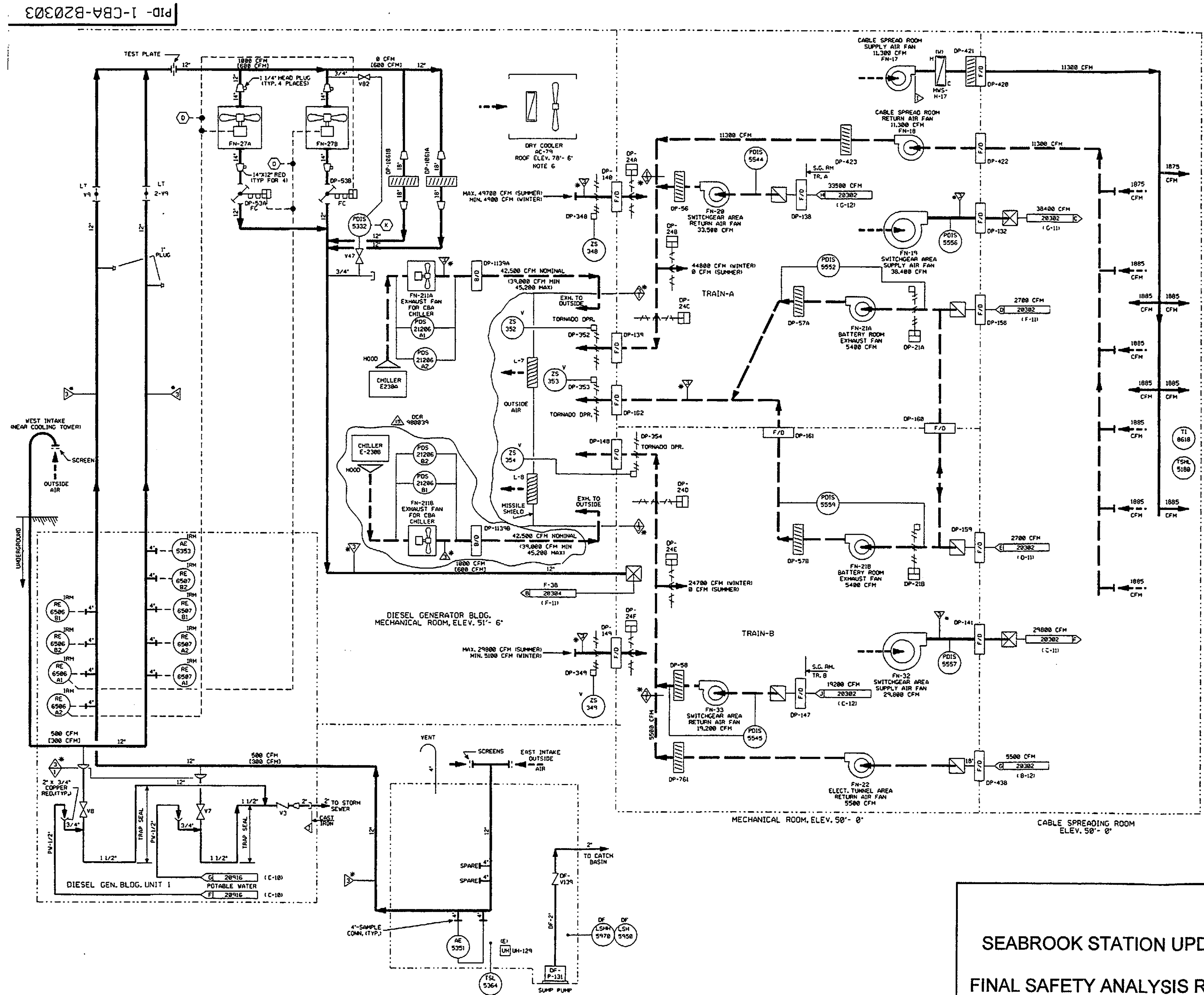
1. ALL HVAC. EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX DAH UNLESS NOTED.
2. THE DAH SYSTEM IS A ONE DWG. SYSTEM, AN OVERVIEW IS NOT REQUIRED.
3. ALL HVAC. EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS N UNLESS NOTED.
4. ———— - INDICATES DUCTED SUPPLY AIR
5. — — — - INDICATES DUCTED EXHAUST OR RETURN AIR
6. - - - - - - - INDICATES NON DUCTED AIR
7. ADDITIONAL AIR HANDLING FOR DIESEL GENERATOR BLDG. SHOWN ON 1-CBA-B20303.
8. △ INDICATES REVISION LEVEL.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	DIESEL GENERATOR BUILGING AIR HANDLING	
	1-DAH-B20624	FIGURE 9.4-16

03/24/00 REV. 05



FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES :

1. WORK THIS DRAWING WITH 20300, 20302 & 20304 THRU 20306.
2. ALL HVAC, EQUIP. & INSTRUMENTS HAVE SYSTEM PREFIX CBA, UNLESS NOTED.
3. FOR SYMBOL LEGEND SEE DRAWING 20302.
4. INSTRUMENT REFERENCES :
   - (A) INTERLOCK WITH 2-CBA-FN-27A & 2-CBA-DP-53B
   - (B) INTERLOCK WITH 2-CBA-FN-27B & 2-CBA-DP-53A
   - (D) INTERLOCK WITH FILTER RECIRC. SIGNAL LOGIC DIA 503231
   - (K) TO DP-28 ON DWG 20304
5. DELETED
6. REFRIGERANT PIPING SHOWN ON DWG. 20306.
7. DELETED
8. DELETED
9. △ INDICATES REVISION LEVEL.

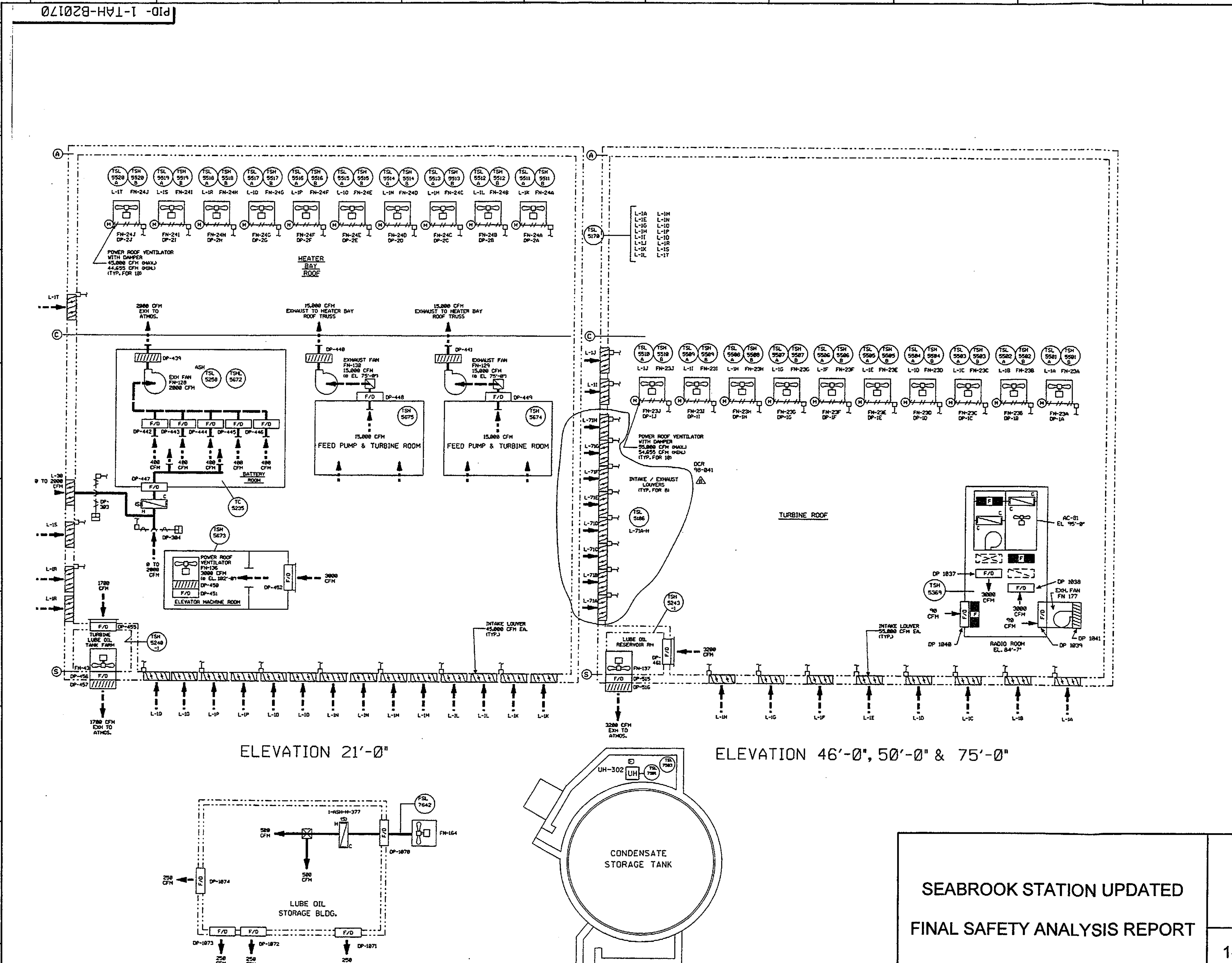
PORTIONS OF THIS DRAWING ARE **NUCLEAR SAFETY RELATED**

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	CONTROL BUILDING AIR HANDLING DETAIL	
	1-CBA-B20303	FIGURE 9.4-19

03/24/00 REV. 15

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



NOTES:

1. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS HAVE SYSTEM PREFIX TAH UNLESS NOTED.
2. WORK THIS DWG. WITH DWG'S. 20171 AND 20172.
3. ALL LINES, EQUIPMENT, COMPONENTS AND INSTRUMENTS ARE SAFETY CLASS NNS UNLESS NOTED.
4. LEGEND:
   - DUCTED SUPPLY
   - DUCTED RETURN
   - NON DUCTED SUPPLY OR RETURN
   - S — SUCTION PIPING
   - L — LIQUID PIPING
5. △ INDICATES REVISION LEVEL.

SEABROOK STATION UPDATED

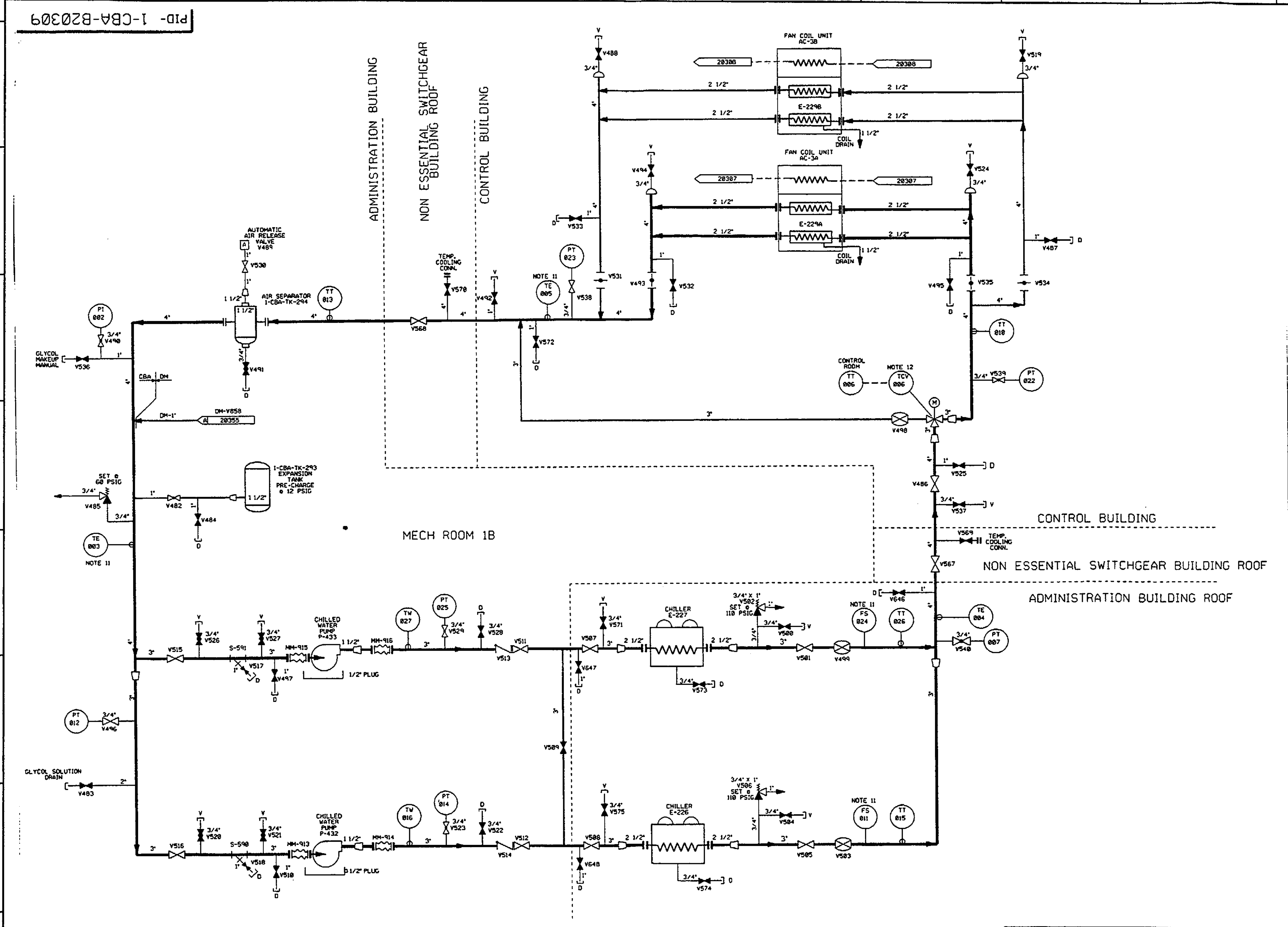
FINAL SAFETY ANALYSIS REPORT

TURBINE BUILDING
AIR HANDLING
DETAIL

1-TAH-B20170

FIGURE 9.4-24 SH1

06/15/00 REV. 08



REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2

NOTES:

1. WORK THIS DWG WITH DWGS 20300 & 20302 THRU 20308.
2. ALL EQUIPMENT, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX CBA UNLESS NOTED.
3. ALL EQUIPMENT, COMPONENTS & INSTRUMENTS ARE NNS UNLESS NOTED.
4. CLEANLINESS CLASS "C".
5. INTEGRITY TEST BOUNDARY INCLUDES ALL PIPING AND EQUIPMENT INCLUDING CHILLERS, PUMPS, TANKS AND COOLING COILS.
6. △ INDICATES REVISION LEVEL.
7. SYSTEM DESCRIPTION NUMBER IS SD-41.
8. ALL PIPING IS PIPE CLASS M3.
9. ALL INSTRUMENT TAG NOS. HAVE PREFIX 21 UNLESS OTHERWISE NOTED. E.G. 1-CBA-PI-21002.
10. CHILLED WATER FLOW TO ONE AC UNIT AT A TIME.
11. FLOW SWITCHES & TEMPERATURE ELEMENTS FURNISHED BY CHILLER MANUFACTURER AND INSTALLED IN FIELD.
12. TCV-21006 FAILS AS IS ON LOSS OF POWER, FAILS TO FULL COOLING ON LOSS OF SIGNAL WITH POWER.

REF. DRAWING NO.	REV	TITLE
9763-F-604167	11	CONTROL RM AIR COND SYS. REFRIG.

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

CONTROL BUILDING
AIR CONDITIONING SYSTEM
SAFETY RELATED
NSS CHILLED WATER SYSTEM

DCR 98 0039

1-CBA-B20309

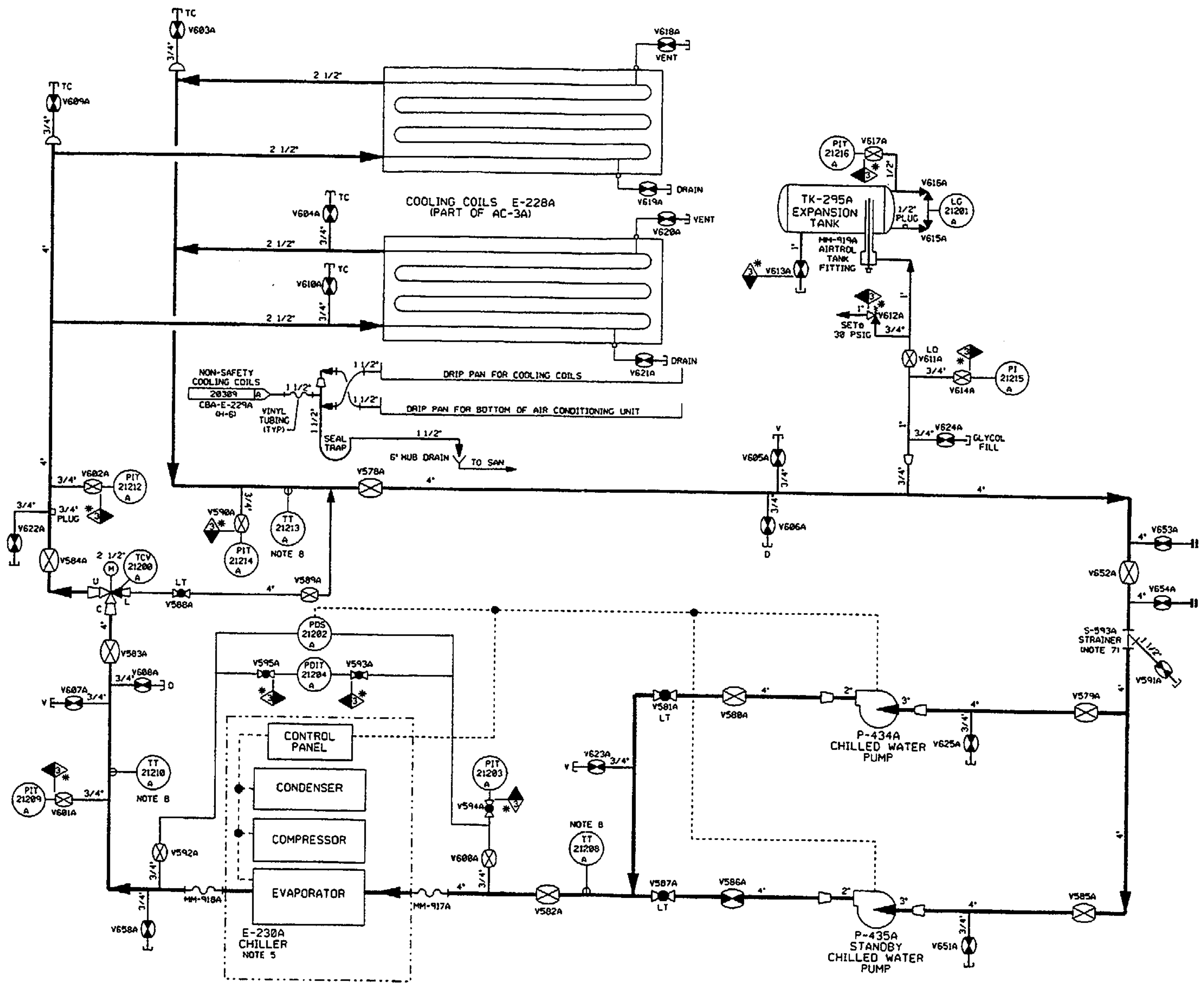
FIGURE 9.4-25

05/02/00 REV. 06

PID- 1-CBA-B20307

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS
REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



NOTES:

1. WORK THIS DWG WITH DWGS 20300 & 20302 THRU 20306, 20308 & 20309.
2. ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX CBA UNLESS NOTED.
3. ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS ARE ◁3 * UNLESS NOTED.
4. △ INDICATES REVISION LEVEL.
5. REFER TO FP-62418 (E-230A) FOR THE SKID MOUNTED INSTRUMENTS.
6. VENTS, DRAINS, AND TEST CONNECTIONS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-605111, UNLESS NOTED OTHERWISE.
7. STRAINER CBA-S-593A IS TO HAVE THE STRAINER BASKET REMOVED AFTER INITIAL START-UP OF THE SYSTEM.
8. ALL "TT" TEMPERATURE TRANSMITTERS ARE NNS. THERMOWELLS ARE SAFETY CLASS ANS 3.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

REF. DRAWING NO.	REV	TITLE
9763-F-604167	11	CONTROL RM AIR COND SYS. REFRIG.

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

CONTROL BUILDING
AIR CONDITIONING SYSTEM
SAFETY RELATED
CHILLED WATER SYSTEM
TRAIN A DETAIL

DCR 98 0039

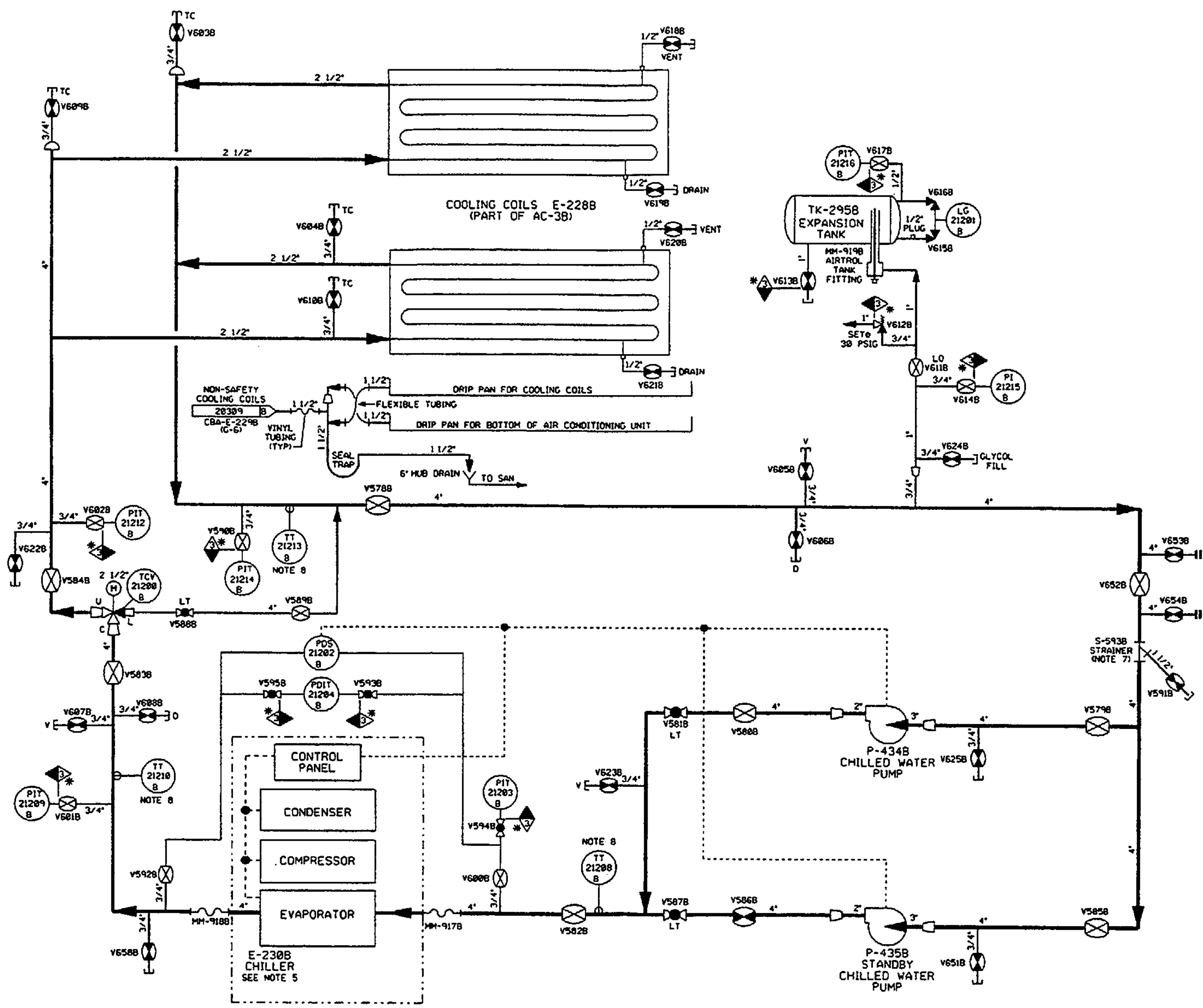
1-CBA-B20307

FIGURE 9.4-26

PID- 1-CBA-B20308

REV. 07

FOR P&ID REFERENCE DRAWINGS, SYMBOLS AND ABBREVIATIONS REFER TO DRAWINGS P&ID - LEGEND 1 AND P&ID - LEGEND 2



NOTES:

1. WORK THIS DWG WITH DWGS 20300 & 20302 THRU 20309.
2. ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS HAVE SYSTEM PREFIX CBA UNLESS NOTED.
3. ALL LINES, EQUIPMENT, COMPONENTS & INSTRUMENTS ARE *3 UNLESS NOTED.
4. △ INDICATES REVISION LEVEL. 6 DCR 980039
5. REFER TO FP-62478 (E-230B) FOR THE SKID MOUNTED INSTRUMENTS.
6. VENTS, DRAINS AND TEST CONNECTIONS CODE BREAKS ARE AT THE DOWNSTREAM END OF THE OUTER ISOLATION VALVE PER 1-NHY-805111, UNLESS NOTED OTHERWISE.
7. STRAINER CBA-S-593B IS TO HAVE THE STRAINER BASKET REMOVED AFTER INITIAL START-UP OF THE SYSTEM.
8. ALL "TT" TEMPERATURE TRANSMITTERS ARE NNS. THERMOWELLS ARE SAFETY CLASS ANS 3.

PORTIONS OF THIS DRAWING ARE

NUCLEAR SAFETY RELATED

REF. DRAWING NO.	REV	TITLE
9763-F-604167	11	CONTROL RM AIR COND SYS. REFRIG.

SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

CONTROL BUILDING
AIR CONDITIONING SYSTEM
SAFETY RELATED
CHILLED WATER SYSTEM
TRAIN B DETAIL

DCR 98 0039

1-CBA-B20308

FIGURE 9.4-27