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ASEA BROWN BOVERI

January 24, 1992
LD-92-006

Docket No. 52-002

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Response to NRC Requests for Additional Information

Reference: Letter, Plant Systems Branch RAIs, T. V. Wambach (NRC) to E. H. Kennedy (C-E), dated October 10, 1991

Dear Sirs:

The reference requested additional information for the NRC staff review of the Combustion Engineering Standard Safety Analysis Report - Design Certification (CESSAR-DC). Enclosure I to this letter provides our responses to a number of these questions including corresponding revisions to CESSAR-DC. Please note that an extra set of the large fold-out drawings is included.

Should you have any questions on the enclosed material, please contact me or Mr. Stan Ritterbusch of my staff at (203) 285-5206.

Very truly yours,

COMBUSTION ENGINEERING, INC.

S E Ritterbusch for EHK

E. H. Kennedy
Director
Nuclear Systems Licensing

/lw
Enclosures: As Stated

cc: J. Trotter (EPRI)
T. Wambach (NRC)

Drawings To Reg File
T. Wambach - (Advanced) 1/29/92

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Enclosure I to
LD-92-006

RESPONSE TO NRC REQUESTS FOR ADDITIONAL INFORMATION
PLANT SYSTEMS BRANCH

Question 280.2

NUREG-0800 is not a sufficient fire protection design basis for the System 80+* design. Please commit to the current NRC fire protection guidance provided in SRP Section 9.5.1 (BTP CMEB 9.5-1), (July 1981) and supplemental guidance issued by the Commission. Three examples of such supplemental guidance are (1) Generic Letter 81-12, which contains information on safe shutdown methodology: (2) Generic Letter 86-10, which contains important technical information, such as conformance with National Fire Protection Association codes and standard; and (3) the commission's staff requirements memorandum (SRM) dated June 26, 1990.

Response 280.2

CESSAR-DC Section 9.5.1.1 will be revised to include a commitment to follow the fire protection guidance outlined in the enclosure to SECY-90-016, dated January 12, 1991. This is consistent with the commission's staff requirements memorandum (SRM) dated June 26, 1990. This guidance has been incorporated in the design of System 80+*.

A commitment to follow the definition of "associated circuits" as outlined in Revision No. 1, to generic letter 81-12 will be included. This commitment will be included in Section 9.5.1.4 of CESSAR-DC. Please refer to the response to RAI 280.11.

Revision 1 of Generic letter 81-12 issued March 22, 1982 provides clarifying information on safe shutdown and alternative safe shutdown capability required by 10CFR50 Appendix R and clearly defines the term "associated circuits." Generic letter 86-10 addresses the implementation of 10CFR50 Appendix R and issues further guidance in the form of the document entitled "Interpretations of Appendix R." Section 7.0 of enclosure (2) of Generic letter 86-10 addresses specific issues contained in NUREG-0800, Section 9.5.1. This section as well as the rest of 86-10 will be used for general guidance and clarification as necessary in the design of the System 80+™.

Section A on page 9.5.1-9 of NUREG-0800 contains the following:

> "This Branch Technical Position (BTP) presents guidelines acceptable to the NRC staff for implementing this criterion in the development of a fire protection program for nuclear power plants. These revised guidelines include the acceptance criteria listed in a number of documents, including Appendix R To 10CFR Part 50 and 10CFR Part 50, and 50.48."

Therefore, the commitment to providing a program consistent with NUREG-0800, Section 9.5.1, "Standard Review Plan" and SECY 90-16, will result in a fire protection program that is consistent with or superior to the guidance of Generic letters 81-12 and 86-10.

A marked-up copy of CESSAR-DC Section 9.5.1.1 is attached for review. This change will be incorporated in a future CESSAR-DC amendment.

9.5 OTHER AUXILIARY SYSTEMS

9.5.1 FIRE PROTECTION SYSTEM

9.5.1.1 Design Basis

The design basis of the System 80+ Standard Design fire protection system employs defense-in-depth systems approach in combination with an integrated program including operational surveillance, testing, maintenance, administrative controls, and Quality Assurance to provide a fire safe plant consistent with NUREG-0800, Section 9.5.1, "Standard Review Plan," AND SECY-90-16 "Evolutionary Light Water Reactor (LWR) Certification Issues" And Their Relationship to Current Regulatory Requirements."

9.5.1.1.1 Goals

A. Prevent release of radioactive contamination in excess of 10 CFR Part 100 limits.

B. Prevent loss of ability to achieve safe shutdown following fire.

C. Prevent fire from threatening more than any one electrical channel or mechanical division of equipment or components required to achieve cold shutdown. I

D. Prevent fire from damaging more than any one electrical channel or mechanical division of safety related structures, equipment, or components.

E. Mitigate the potential of personnel injury due to fire.

F. Preserve unit availability by limiting potential fire damage to an acceptable level.

G. Protect capital investment in the facility.

9.5.1.1.2 Objectives

A. Station design and layout to prevent the possibility of fire affecting redundant channels and divisions of equipment required for cold shutdown. Safe shutdown as defined in the Standard Review Plan pertains to cold shutdown as part of the System 80+ design philosophy. This includes potential interaction with other plant systems and to prevent a fire induced LOCA.

B. Plant layout to assure adequate access and egress routes for personnel protection.

Question 280.3 (9.5.1.1)

In Section 9.5.1.1.2.c, the applicant indicates that where redundant channels of safety related divisions are located in the same fire area automatic sprinklers and fire detectors are provided. This philosophy seems inconsistent with the 3-hour fire rated separation criteria described in Section 9.5.1.4, Safe Shutdown Following Fire. It is our position, advanced reactor designs should fully demonstrate that redundant divisions and channels of safety related and non-safety related systems including the necessary support systems required to achieve and maintain safe shutdown conditions are maintained free from fire damage and separated by 3-hour fire barriers. For those areas where separation can not be achieved, please identify the function which could potentially be lost due to fire and the impact that these lost functions may have on the plants ability to achieve and maintain safe shutdown conditions.

Response 280.3 (9.5.1.1)

Outside of containment, complete division separation is maintained with 3-hour fire barriers. Within a division, separation of redundant channels will be maintained with 3-hour barriers except where by necessity the channels must converge. However, this will be done as a matter of good engineering practice since the channels are redundant only in that both must fail in order to have a spurious activation. Failure or loss of a channel will require that the opposite division be utilized.

Inside containment, separation will be through use of mineral insulated jacketed cable which will provide either a three hour rating or a radiant heat shield, or spatial separation, or a combination there of. If the cable insulation qualifies only as a radiant heat shield, engineering analysis will verify that the heat shield coupled with minimum 20 ft. separation between redundant divisions will withstand any credible fire occurrence.

In the unlikely event that as-procured equipment cannot be adequately separated, sprinklers and fire detectors will be used.

Therefore, there are no areas where redundant division functions could be lost from a single fire. Section 9.5.1.1.2 of CESSAR-DC will be revised accordingly for clarification.

A marked-up copy of Section 9.5.1.1.2 of CESSAR-DC is attached for review. In addition, to avoid conflict in CESSAR-DC, Section 9.5.1.2 must also be revised accordingly, therefore, a marked-up copy of this section is also attached. These revisions will be included in a future CESSAR-DC update.

C. Outside Containment and the Annulus: Provision of three-hour fire rated barriers between redundant divisions ~~and redundant channels~~ of safety-related equipment. ~~Where redundant channels of a safety-related division are located in the same fire area, automatic sprinklers and fire detectors are provided~~. Exceptions are control room and the remote shutdown panel room which are physically separated and electrically isolated from each other as described herein.

Safe cold shutdown can be achieved following fire in any area assuming all equipment in the fire area (or inside containment; at the specific location) is rendered inoperable and that reentry into the fire area for repairs and operator actions is not possible.

Inside Containment and Annulus: See insert next page. ~~Separation of redundant divisions and channels by quadrant by at least 20 feet without intervening combustibles in the annulus and at containment penetrations. Where redundant channels of equipment normally used to achieve cold shutdown, by necessity, converge, an engineering analysis will be conducted (when sufficient design detail is available) to assure that cold shutdown can be achieved utilizing equipment which would not be affected by fire at the specific location. The engineering analysis will be maintained as part of the System 80+ design basis.~~ I

D. Fire detection and alarm systems to provide prompt detection and notification of fire.

E. Fixed automatic sprinkler systems to assure prompt fire suppression consistent with design objectives.

F. Manual fire fighting equipment for early fire suppression and for structural fire fighting.

G. Smoke control systems to facilitate manual fire fighting and mitigate smoke migration beyond the area of fire origin.

H. A fire prevention program including housekeeping control of combustible materials, control of potential ignition sources, and a program of management inspections, audits and reviews.

I. A fire response program consisting of well trained and equipped plant personnel prepared at all times to assume fire fighting responsibilities.

RAI 280.3

Insert for Section 9.5.1.1.2.C of CESSAR-DC Amendment I.

Separation of redundant divisions by quadrant to provide sufficient spatial separation, as proven by engineering analysis in the annulus and at containment penetrations. Another option for separation is through use of mineral insulated jacketed cables which qualify as either a three hour rated barrier or a radiant heat shield. If it qualifies as a radiant heat shield, engineering analysis will verify that the heat shield coupled with minimum 20 ft. separation between redundant divisions with no intervening combustibles, and/or augmented with sprinklers and automatic fire detectors, will withstand any credible fire occurrence. Where redundant divisions of equipment normally used to achieve cold shutdown, by necessity, converge, an engineering analysis will be conducted (when sufficient design detail is available) to assure that cold shutdown can be achieved utilizing equipment which would not be affected by fire at the specific location. The engineering analysis will be maintained as part of the System 80+ design basis.

J. Operations and maintenance programs for surveillance, testing and maintenance of fire protection systems and features.

K. A Quality Assurance program to assure design methods and features are properly implemented. The Quality Assurance program also verifies that operations, maintenance, and surveillance programs are properly implemented.

The Design Basis Goals and Objectives as stated above will mitigate the potential of fire, provide for prompt detection should fire occur, provide automatic suppression and/or manual fire suppression capabilities as determined by the Fire Hazards Analysis, provide fire resistant barriers to mitigate fire propagation, protect redundant safety related trains of equipment from damage due to a common fire exposure, and preclude the potential release of radioactivity to the environment.

9.5.1.2 General Design Guidelines

A. Outside containment redundant divisions ~~and redundant channels of each division~~ of safety related electrical equipment are separated from each other by three-hour fire rated fire barriers. ~~Where redundant channels of a safety related division are located in the same fire area, automatic sprinklers and fire detectors are provided.~~ Exceptions are control room and remote shutdown panel room which are physically separated, electrically isolated, and provide redundant shutdown capability. I

See insert next page.

B. ~~Inside containment and the annulus channels of safety related equipment are generally confined to the assigned quadrant. Redundant divisions and channels of each division are separated in the annulus and at containment penetrations by at least 20 feet without intervening combustible material. Where redundant divisions of equipment normally used for cold shutdown by necessity converge, an engineering analysis verifies that cold shutdown can be achieved using other systems and equipment which would not be affected by fire at that location.~~

C. A fire protection water supply is installed, with redundancy and reliability to meet provisions of BTP CMEB 9.5-1.

D. Fixed automatic suppression systems are installed, engineered for the specific hazard to be protected in accordance with the design objectives as determined by the Fire Hazards Analysis.

Insert for Section 9.5.1.2 of CESSAR-DC Amendment I.

Separation of redundant divisions by quadrant provide sufficient spatial separation in the annulus and at containment penetrations as proven by engineering analysis. Another option for separation is through use of mineral insulated jacketed cables which qualify as either a three hour rated barrier or a radiant heat shield. If it qualifies as a radiant heat shield, engineering analysis will verify that the heat shield coupled with minimum 20 ft. separation between redundant divisions with no intervening combustibles, and/or augmented with sprinklers and automatic fire detectors, will withstand any credible fire occurrence. Where redundant divisions of equipment normally used to achieve cold shutdown, by necessity, converge, an engineering analysis will be conducted (when sufficient design detail is available) to assure that cold shutdown can be achieved utilizing equipment which would not be affected by fire at the specific location. The engineering analysis will be maintained as part of the System 80+ design basis.

Question 280.4

a. In Section 9.5.1.1.2.c, the applicant provides for separation of redundant divisions and channels by at least 20 feet without intervening combustibles in the annulus and at the containment penetrations. This level of separation may not be sufficient to assure both redundant divisions are maintained free from fire damage. The staff recognizes the need for open communication between compartments inside the containment so that pressure following a high-energy line break can be relieved and equalized. Therefore, the use of structural walls inside the containment as fire barriers to separate safety-related systems (cabling, components, and equipment), even though such walls may not fully enclose the equipment requiring separation, is acceptable. However, care must be taken in actual system layout to ensure that line-of-sight exposure between components requiring separation does not exist and that a sufficient labyrinth exists between the separated components to ensure that fire does not spread. Since the containment is considered to be a single fire area, the separation of redundant shutdown equipment, including associated cables, should be such that one shutdown division will remain free of fire damage.

b. In addition, this separation criteria seems to be inconsistent with the criteria identified by SRP Section C.5.b.(2)(b), in that no detection or automatic fixed suppression is provided for these areas. Please provide additional justification as to why the proposed level of fire protection is equivalent to the level required by the SRP.

Response 280.4

a. Redundant division equipment and cables inside containment required for safe shutdown following fire will be spatially separated without intervening combustibles, and in addition, engineering analysis will show that at least one division of cables will remain free from fire damage. Another option will be to use mineral insulated jacketed cable for the shutdown cables to provide either a three hour fire resistance rating or a radiant heat shield. If the cable insulation qualifies only as a radiant heat shield, engineering analysis will show that it, coupled with minimum 20 ft. separation, and/or augmented with sprinklers and automatic fire detectors, is sufficient to withstand any credible fire.

A marked up copy of Section 9.5.1.1.2.C of CESSAR-DC is attached to the response to RAI 280.3 for review. This revision will be included in a future CESSAR-DC amendment.

b. Fire detectors and suppression will be provided inside the annulus and containment if warranted by the fire hazards analysis based on as-procured equipment. It is the intent to provide adequate separation between redundant division cables as described in the response to Part A of this RAI, to preclude the need for detection and suppression in the annulus and containment. This is consistent with the criteria outlined in C.5.b.(2)(b), Section 9.5.1 of the Standard Review Plan.

Question 280.5

Figure 9.5.1-4, is not clear concerning possible communication between the Divisions I and II Diesel Generator Rooms and their supporting facilities.

Response 280.5

General arrangement and fire barrier drawings are currently being revised which will show the supporting facilities for each diesel generator. The diesel generators and all of their associated support facilities will be electrically separated and physically separated from each other by 3-hour rated structural fire barriers. A future update of CESSAR-DC will include these revised drawings.

Question 280.6

Section 9.5.1.4, Safe Shutdown Following Fire, indicates that each division and redundant channel of safety related equipment are separated by 3-hour fire barriers. Section 9.5.1.6.2, Ventilation Systems indicates that the ventilation systems are division-specific so that fire or smoke cannot migrate through the ventilation ducts to all area containing the redundant division. In addition, the applicant's response to Question 280.1, indicated that the System 80+* design does not have connections (door or ventilation openings) between redundant safety-related divisions. However, in Sections 9.5.1.3.2.1, 9.5.1.3.2.4, and 9.5.1.6.2, the applicant indicates fire dampers are used. In order to get a better understanding on how fire spread and smoke migration is controlled by the HVAC design, please describe the system logic for the smoke and the fire control modes of operation. In addition, describe those cases where fire dampers are used within a division-specific ventilation system.

Response 280.6

Please see the Response to RAI 280.19 for a description of the smoke control system.

There will be no HVAC ducts penetrating division-separating fire walls in the nuclear annex, therefore there will be no fire dampers in these barriers. Fire dampers will, however, be used where ducts penetrate fire barriers that are intradivisional. For example, fire dampers will be used where ducts penetrate the vertical 3-hour rated HVAC chase in the Division 1, Channel A switch gear room located on Elevation 70+0. This assures that fire will not spread vertically from this room to the Division 1, Channel A rooms located above and below on Elevations 50+0 and 91+9 respectively.

Fire dampers will be used in duct penetrations through fire barriers that separate safety related from non-safety related areas, and that separate non-safety fire related areas.

Question 280.7

Section 9.5.1.3.2.6, Fire Insulating Material, indicates that there may be cases where fire insulating materials for cabling may be necessary. It is our position, for advance reactor designs, complete divisional separation by 3-hour fire rated barriers provides the most conservative approach towards assuring that one train of systems necessary to achieve and maintain safe shutdown is free from fire damage. Please justify how the use of cable fire insulating material provides the same equivalent level of fire protection to that afforded by spatial separation and a 3-hour fire barrier wall assembly.

Response 280.7

Outside containment, complete divisional separation will be maintained by 3-hour rated fire barriers. Redundant channels, within a division required for safe shutdown following a fire will be separated with 3-hour rated barriers unless, by necessity, the channels must converge. For any of those areas, separation will be maintained by the use of 3-hour rated cable jacketing (mineral insulated cable), radiant heat shields and spatial separation, or fire rated insulating material. Inside containment, divisional and redundant channel separation will be maintained through use of 3-hour rated cable jacketing, radiant heat shields and spatial separation, or fire rated insulating material. Because insulating materials may not be equivalent to spatial separation and a 3-hour barrier, the use of fire insulating materials will be avoided unless it is absolutely necessary.

Question 280.8 (9.5.1.3)

Section 9.5.1.3.4 states that an engineering analysis would be provided for materials which do not meet or have not been tested in accordance with UL 84 or UL 251. An engineering analysis alone will not be acceptable for materials which do not meet or have not been tested to the UL 85 or UL 251 qualification. Such materials will be required to pass the appropriate test prior to use in the System 80+ design.

Response 280.8 (9.5.1.3)

It is the intent that for any materials that do not meet or have not been tested to the requirements of UL 84, "Steiner Tunnel Test," or UL 251, "Fire Tests of Building Construction and Materials," that an engineering analysis will confirm that the material does not reduce the level of fire protection/safety in the plant. For example, it may be necessary to use a type of insulation that has a smoke development rating of more than 100. An engineering analysis would be necessary to prove that using this insulation does not degrade or reduce the level of protection required. This analysis along with the fire hazards analysis will identify specific fire protection features needed to ensure an adequate level of protection is provided.

If validated engineering models are available that can be utilized to qualify the materials, which is normally done by testing, they will be considered for use in performing the analysis for materials which have not been tested.

Question 280.9 (9.5.1.3)

Confirm that sealed beam, battery powered emergency lighting units have a minimum 8-hour battery capacity.

Response 280.9 (9.5.1.3)

Sealed beam, battery powered emergency lighting units that are provided for illumination of areas and access to areas that must be occupied for safe shutdown shall have a minimum 8-hour battery.

Sealed beam, 8-hour minimum battery powered emergency lighting units shall be provided for all areas and access to areas that must be occupied for safe shutdown of the plant. A marked-up copy of Section 9.5.1.3.5 of the CESSAR-DC is attached. This revision will be incorporated in a future CESSAR-DC update.

Flame spread, fuel contribution, and smoke development are measured in accordance with UL 84, "Steiner Tunnel Test." Critical radiant flux is measured in accordance with UL 251, "Fire Tests of Building Construction and Materials."

If it is necessary to select a specific material which does not meet or has not been tested to the above qualifications (in the installed configuration), an engineering analysis will confirm that the General Design Guidelines are met and there is no reduction in the fire safe quality of the plant.

9.5.1.3.5 Means of Egress

Personnel egress in the Nuclear Annex is arranged to meet provisions of NFPA 101, "Life Safety Code" or NFPA 101m, Alternative Approaches to Life Safety."

There are stairs in each quadrant of the Nuclear Annex enclosed by three-hour fire rated walls. Each stair tower is pressurized by a dedicated fan mounted at the top of the tower. Personnel access/egress corridors are arranged to assure an unobstructed path of travel. Three-hour fire rated doors are installed along the corridors to assure a maximum of 200 feet travel to an exit or area of refuge.

There are three stair towers in the Reactor Building Subsphere. Each is located in a separate quadrant of the Reactor Building. Access/egress into the Containment Building is through two personnel air locks, one located on elevation 115+6 and one located on elevation 146+0. I

Sealed beam, battery powered emergency lighting units are installed to illuminate emergency egress paths in accordance with standards of the American Illuminating Society.

9.5.1.4 Safe Shutdown Following Fire

The System 80+ plant arrangement and layout provides inherent separation of safety related systems, equipment and components, divisions and channels. The plant arrangement permits the unit to be taken to cold shutdown following a fire without the need to implement repairs or for operators to perform extraordinary manual actions outside of the control room or remote shutdown panel room.

In the Nuclear Annex, each division and redundant channels of safety related equipment are separated by three-hour fire rated

Sealed beam, 8-hour minimum battery powered emergency lighting units are provided for all areas and access to areas that must be occupied for safe shutdown of the plant following a fire.

Question 280.10 (9.5.1.4)

The third paragraph states that separation of electrical power, control and instrumentation must comply with the requirements of IEEE 384-1. They must also be physically separated in accordance with the requirements of Appendix R to 10 CFR part 50, Section III.G.2.a using 3-hour fire rated barriers.

The fourth paragraph states that, "cables of redundant safety-related divisions and channels enter the Reactor Building on Elevation 81+0, Division 1, which consists of channels A and c, enters the reactor building form opposite sides, as does Division 2, which consists of channels B and D." Figures 9.5.1-3 and 9.5.1-4 do not show these Divisions 1 and 2 cables entering on opposite sides. Please clarify.

Response 280.10 (9.5.1.4)

Redundant division and channel cables are separated as stated in Sections 9.5.1.1.2, 9.5.1.2, and paragraph No. 2 in Section 9.5.1.4 of the CESSAR-DC. This separation criteria is clarified in the responses to RAI 280.3 and 280.4.

Cables of redundant safety related divisions and channels enter the Reactor Building on Elevation 91+9. As shown on Figure 9.5.1-4,- A and B Penetration Rooms are located on one side of the Reactor Building and Channels C and D Penetration Rooms are located on the opposite side. The cables leave these rooms, traverse the annulus, and enter containment.

Figure 9.5.1-4 as well as the rest of the Nuclear Island Fire Barrier Walls Figures have been revised and will be included in a future CESSAR-DC update. [An advance copy of the revised arrangement drawings is currently being transmitted via a separate letter.] The arrangement of the Penetration Rooms has not changed.

CESSAR-DC Section 9.5.1.4 will be revised in a future CESSAR-DC update. A marked-up copy of this section has been attached to RAI 280.11.

Question 280.11 (9.5.1.5)

Section 9.5.1.4, Safe Shutdown Following a Fire, discusses electrical separation and independence. Please provide a discussion on how the System 80+ design addresses high-low pressure interface and fire induced spurious operation concerns and SRP 9.5.1, position C.5.c.(7).

Response 280.11 (9.5.1.5)

Per Section 7.6 of the CESSAR-DC, there are three shutdown cooling system suction line valves in series for each of the two shutdown divisions. Interlocks are provided to preclude opening of the valves unless low RCP pressure is indicated from two separate pressure sensors located at the pressurizer. Operator action cannot override the interlocks. For the System 80+ design, spurious opening of the valves as a result of a fire will be prevented by complete separation of valve control and power cables by 3-hour barriers in conjunction with the system interlocks or by an administrative procedure that requires at least one of the valves in each division to be deenergized during normal plant operating conditions.

SRP 9.5.1, Position C.5.c.(7) requires that safe shutdown equipment and systems in each fire area be isolated from associated circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. As described in Section 9.5.1.4 of the CESSAR-DC, electrical power, control, and instruments are separated and electrically independent to preclude electrical interaction and associated circuit failures. Associated circuits, as defined in Revision 1 to Generic letter 81-12, will be avoided. This has been clarified in the marked up copy of Section 9.5.1.4 attached for review. This revision will be included in a future CESSAR-DC update.

barriers. Exceptions are the control room and the remote shutdown panel room which contain safety related equipment of each division and channel. The control room and the remote shutdown panel room are essentially redundant to each other so that fire in either room will not affect the ability to achieve cold shutdown from the unaffected control system.

Electrical power, control, and instruments are separated and electrically independent to preclude electrical interaction and associated circuit failures in accordance with IEEE 384-1, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits." Associated circuits, as defined in Revision 1 to Generic letter 81-12, will be avoided.

Cables of redundant safety related divisions and channels enter the Reactor Building on elevation ~~81+00~~ 91+9. Division 1, which consists of Channels A and C, enters the Reactor Building from opposite sides, as does Division 2, which consists of Channels B and D. Channels A and B, which enter the Reactor Building in close proximity, are separated by a three-hour fire rated barrier. Likewise, Channels C and D, which enter the Reactor Building in close proximity, are separated by a three-hour fire rated barrier. These cables then transgress the annulus. Each safety related channel enters the annulus in a separate quadrant and is separated from the other safety related channels by at least 20 feet, without intervening combustibles. Where it is not possible to maintain 20 feet without intervening combustibles, cables are enclosed in three-hour fire rated barriers or heat shields until 20 feet separation is achieved. Cable ampacity will be derated in accordance with the characteristics of the insulating material. I

Inside containment, safety related cables generally are confined to their respective quadrants. Where redundant divisions of safety related cables normally used for cold shutdown converge inside containment, an engineering analysis confirms that cold shutdown can be achieved utilizing systems and equipment which would not be affected by fire at that location. In each potential Reactor Building fire scenario, cold shutdown is assured by operation from the control room or remote shutdown panel without repairs or extraordinary operator action outside of the control room or remote shutdown panel room.

9.5.1.5 Fire Protection/Detection/Alarm Systems

The fire penetration water supply and distribution system configuration is as shown in Figure 9.5.1-1, "Fire Protection Water Distribution System."

Heat shields and separation distance will be justified by engineering analysis. In addition, separation will be augmented with sprinklers and automatic fire detectors if required by the analysis.

Question 280.12 (9.5.1.5)

Section 9.5.1.5.2, Water Distribution System, Hydrants, and Hose Houses, the applicant indicates that hydrants with 2-2 1/2 inch gated nozzles will be used on site. These type of hydrants are sufficient to support fire brigade use; however, if off-site assistance is needed and a fire engine is needed to relay water from one of these hydrants to a remote fire location, the capability to supply a fire engine with adequate water may be limited. Consideration should be given to providing fire hydrants which will support the use of fire apparatus if off-site fire fighting assistance is needed.

Response 280.12 (9.5.1.5)

The fire pumps supplying the water distribution system will be of sufficient flow and pressure rating to preclude the need for use of an off-site fire engine. The use of a fire engine pumper could reduce the water supply available to interior sprinkler systems and hose stations which would reduce their effectiveness. Hydrant spacing will be arranged so that all areas of the plant and plant site can be reached without an excessive length of hose lay. In addition, the water distribution system will be designed based on the hydraulic demands of sprinkler systems, interior hose stations, and outside hydrants.

It is anticipated that the System 80+ plant may be constructed in an area where off-site fire fighting assistance is not readily available. For this reason, the System 80+ design includes a fire protection water distribution system, storage tanks, and pumping facilities, to provide all of the water needed to fight a fire within the boundaries of the plant site.

Question 280.13 (9.5.1.5)

In reviewing Figure 9.5.1-1, Fire Protection Water Distribution System, it is noted that a single pipe break in the piping section between the two fire pump discharge lines could render the total fire system inoperable. This condition exists, under limited conditions, at other places on the underground fire water loop (i.e., loss of fire water to onsite structures). This does not seem to be consistent with the criteria discussed in Section 9.5.1.5.2, Water Distribution System, Hydrants, and Hose Houses.

Response 280.13 (9.5.1.5)

An additional valve will be added in the piping section between the two fire pump discharge lines so that no single break could render the total fire system inoperable. A marked-up copy of Figure 9.5.1-1 showing this additional valve is attached. This revision will be included in a future CESSAR-DC update.

Sectional isolation valves are located throughout the water distribution system to assure that any portion of the distribution system that serves buildings containing safety related systems, equipment, and components can be impaired without isolating primary and secondary fire protection. A revised, marked-up copy of the sixth paragraph of Section 9.5.1.5.2 of CESSAR-DC is attached. This revision will be included in a future CESSAR-DC update.

{that serves buildings containing safety related systems, equipment, and components}

Sectional isolation valves are located throughout the water distribution system to assure that any portion of the distribution system can be impaired without isolating primary and secondary fire protection.

The fire protection water distribution system complies with NFPA 24, "Standard for Private Fire Service Mains."

Piping, valves, fittings, and fire hydrants are designed for 175 psi operating pressure.

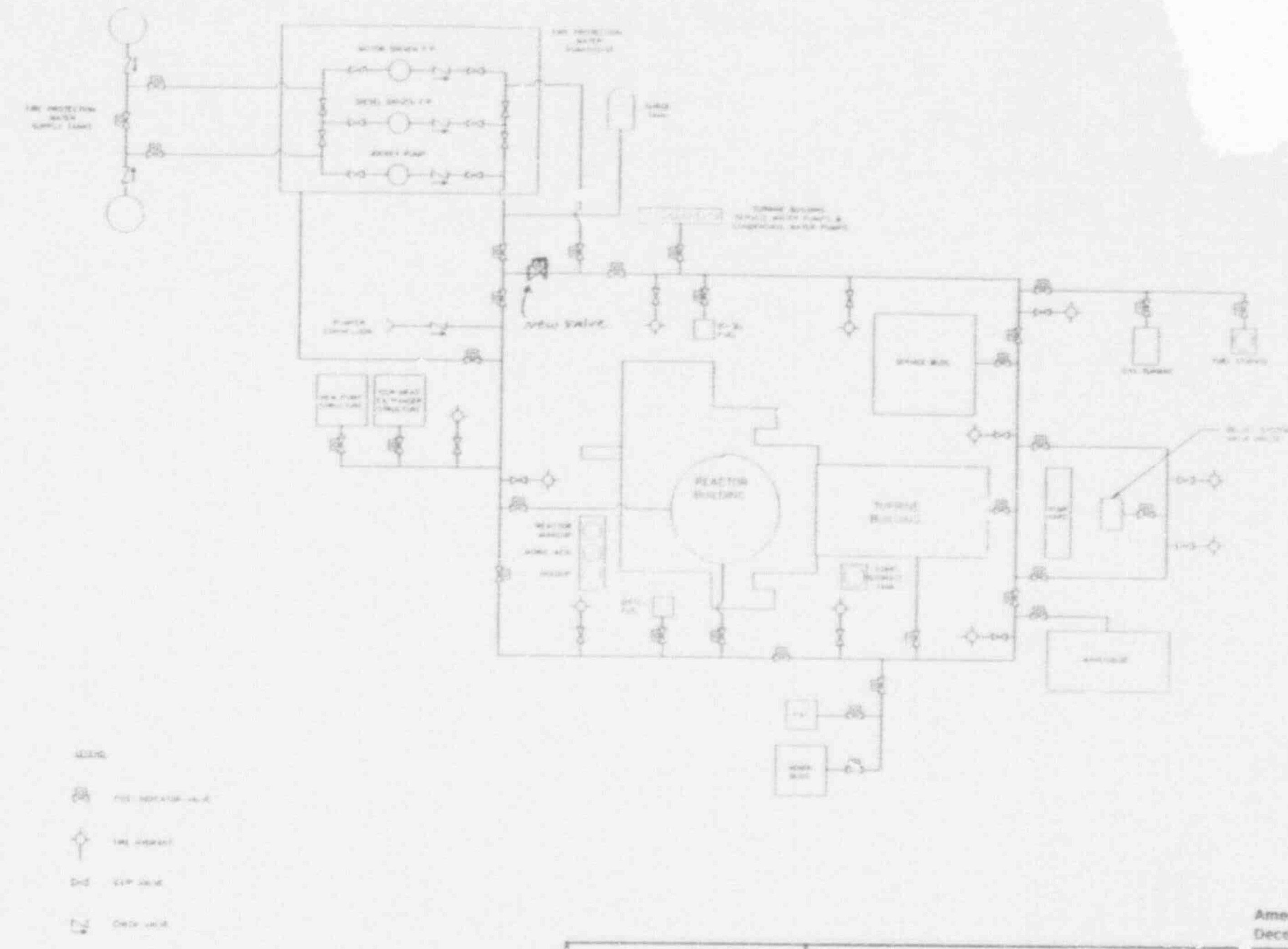
9.5.1.5.3 Automatic Sprinkler Systems

A. Description

Automatic preaction sprinkler systems are utilized for fixed fire protection in the Nuclear Annex, Reactor Building, and the alternate AC source - Combustion Turbine, as determined by the Fire Hazard Analysis. Wet pipe automatic sprinkler systems are used where preaction type systems are not mandated by the plant Design Basis.

A preaction sprinkler system consists of a piping distribution system which supplies water to sprinkler heads which are located based on engineering analysis and requirements of NFPA 13, "Standard for Installation of Automatic Sprinkler Systems," to assure adequate water distribution and to preclude the possibility of interference with the water distribution pattern due to obstruction by other plant equipment and components. Sprinkler heads are normally closed and are actuated by heat sensitive elements. Actuation temperatures of these elements are based on the individual location and application. Distribution piping between the system control station and sprinkler heads is normally dry and pressurized with air or nitrogen. Water is held at a speciality "preaction valve" at the system control station. The system includes a fire detection subsystem activated by fire or smoke detection devices, selected by engineering analysis for the specific location and application based on the Fire Hazards Analysis. Upon activation of a fire detection device, the automatic preaction control valve opens, allowing water into the piping system. I

Water is then discharged only through sprinkler heads in which the heat sensitive element has actuated, thereby applying water only to the area involved in fire. Each preaction sprinkler system has a manual control valve



Amendment I
December 21, 1990

SYSTEM 80+	FIRE PROTECTION WATER DISTRIBUTION SYSTEM FLOW DIAGRAM	Figure 9.5.1-1

Question 280.14 (9.5.1.5)

Section 9.5.1.5.3, Automatic Sprinkler Systems, indirectly infers that the preaction sprinkler systems are air/nitrogen supervised. Please verify if these systems are supervised and revised the system description to reflect the method of supervision.

Response 280.14 (9.5.1.5)

The pre-action sprinkler system piping will be supervised with either air or nitrogen. A marked-up copy of Section 9.5.1.5.3 of CESSAR-DC is attached for review. This revision will be included in a future CESSAR-DC update.

Sectional isolation valves are located throughout the water distribution system to assure that any portion of the distribution system can be impaired without isolating primary and secondary fire protection.

The fire protection water distribution system complies with NFPA 24, "Standard for Private Fire Service Mains."

Piping, valves, fittings, and fire hydrants are designed for 175 psi operating pressure.

9.5.1.5.3 Automatic Sprinkler Systems

A. Description

Automatic preaction sprinkler systems are utilized for fixed fire protection in the Nuclear Annex, Reactor Building, and the alternate AC source - Combustion Turbine, as determined by the Fire Hazard Analysis. Wet pipe automatic sprinkler systems are used where preaction type systems are not mandated by the plant Design Basis.

A preaction sprinkler system consists of a piping distribution system which supplies water to sprinkler heads which are located based on engineering analysis and requirements of NFPA 13, "Standard for Installation of Automatic Sprinkler Systems," to assure adequate water distribution and to preclude the possibility of interference with the water distribution pattern due to obstruction by other plant equipment and components. Sprinkler heads are normally closed and are actuated by heat sensitive elements. Actuation temperatures of these elements are based on the individual location and application. Distribution piping between the system control station and sprinkler heads is normally dry and ~~pressurized~~ supervised with air or nitrogen. Water is held at a speciality "preaction valve" at the system control station. The system includes a fire detection subsystem activated by fire or smoke detection devices, selected by engineering analysis for the specific location and application based on the Fire Hazards Analysis. Upon activation of a fire detection device, the automatic preaction control valve opens, allowing water into the piping system. I

Water is then discharged only through sprinkler heads in which the heat sensitive element has actuated, thereby applying water only to the area involved in fire. Each preaction sprinkler system has a manual control valve

Question 280.15 (9.5.1.5)

Section 9.5.1.5.4, Fire Hose and Standpipe Systems, the criteria being proposed by the applicant for the seismic water supply to manual fire fighting hose stations is not consistent with the criteria identified in SRP Section C.6.c(4). Please justify how the pressure tank concept provides equivalent fire fighting capabilities to that required by the SRP.

Response 280.15 (9.5.1.5)

Section C.6. (4) of the SRP states that provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake. This will be accomplished in the System 80+ design by providing a dedicated SSE qualified water storage pressure tank connected to SSE qualified fire hose and standpipe systems located in areas containing equipment required for safe shutdown. The SSE qualified portions of the standpipe system will be isolated from the remainder of the plant standpipe system through use of SSE qualified check valves. The tank will be sized such that a supply of 250 GPM can be delivered at a residual pressure of 65 PSI at the hydraulically most remote hose connection, for two hours. This will allow the use of multiple 1 1/2 inch hose lines with spray nozzles, which have a flow rate of approximately 60 to 90 GPM. It is expected that 1 1/2 inch hoses will be maximum size deployed in a fire following an SSE, since they are much more maneuverable than 2 1/2 inch hoses. The standpipe and hose connection system will be designed so that all areas of the plant which contain equipment required for safe shutdown can be reached with maximum hose length of 100 ft.

For design purposes, hydraulic calculations will show that 250 GPM can be delivered to the single hydraulically most remote hose connection. This assures a conservative design with regards to sizing of pipe for the standpipe system. This flow rate exceeds the minimum rate suggested (75 GPM at two outlets) in section C.6.c.(4) of the SRP.

It is concluded that the SSE qualified water supply and stand pipe system exceeds the criteria identified in the SRP.

Question 280.16 (9.5.1.5)

In Section 9.5.1.5.5, the statement is made that "water based extinguisher rated at 10 B.C. is installed." No water based extinguishers are approved for Class C (electrical) fires.

Response 280.16 (9.5.1.5)

Section 9.5.1.5.5 of the CESSAR-DC will be corrected to read as follows: "... water based extinguisher rated at 2A is installed." A marked-up copy of Section 9.5.1.5.5 is attached. This change will be included in a future CESSAR-DC update.

9.5.1.5.5 **Portable Fire Extinguishers**

Portable fire extinguishers are located and arranged in accordance with NFPA 10, "Standard for Installation and Use of Portable Fire Extinguishers." An exception is that fire hose stations are utilized for Class A fires except in the control room and computer room where a water based extinguisher rated at ~~10-B.C. is installed.~~ 2A is installed.

Portable extinguishers are located such that extinguisher can be reached with a maximum of 75 feet of travel from any protected location. An exception is that in high radiation areas where the Fire Hazards Analysis determines that there is a minimum of combustible materials and a minimum of risk to safety related equipment or equipment necessary to maintain unit availability, fire extinguishers are located outside of the area where responding fire brigade members can obtain an extinguisher and carry it into the area for use. This is consistent with ALARA principles.

Due to the potential for chemical corrosion of safety related equipment and components, dry chemical extinguishers are not installed in safety related portions of the station. Dry chemical extinguishers are located in the fire brigade equipment room and are used at the discretion of the fire brigade captain. I

Inside containment, during power operation, fire extinguishers are located near the personnel access portals (rather than throughout containment). During maintenance outages, additional fire extinguishers will be moved into containment to support maintenance activities.

Fire extinguishers are located to be accessible. Locations are clearly marked to be prominently visible.

Fire extinguishers are Underwriter's Laboratory Listed or Factory Mutual Approved for use in fire protection service.

9.5.1.5.6 **Fire Detection and Alarm System**

A fixed automatic fire detection system is installed in the Nuclear Annex and portions of the Reactor Building. Areas covered by the fire detection system are established by the Fire Hazards Analysis based on the potential hazard risk to safety related equipment and equipment necessary to maintain unit availability, potential detector effectiveness (based on engineering technique of NFPA 72, "Fire Detection and Alarm Systems"), and ALARA concerns. The fire detector system design

Question RAI 280.17 (9.5.1.5)

In Section 9.5.1.5.6, Fire Detection and Alarm System, the applicants fire detection system design philosophy and proposed areas to be covered by detection does not follow the guidance provided by SRP Section C.6.a. Please justify how the proposed fire detection philosophy provides an equivalent level of detection capability to that required by SRP 9.5.1.

Response 280.17 (9.5.1.5)

As stated in Section 9.5.1.5.6 of the CESSAR-DC, an automatic fire detection system will be provided in the Nuclear Annex and portions of the Reactor Building. Detectors will be provided based on the Fire Hazards Analysis in which the hazard risk to safety related equipment, and equipment necessary to maintain unit availability will be evaluated. In addition, the analysis will utilize engineering techniques for the selection and placement of detectors that are now available as outlined in NFPA 72E that were not available when the SRP was written. Also, the analysis will consider ALARA concerns in the selection and placement of detectors. This analysis will result in an effective, reliable fire detection system that meets or exceeds the guidelines established in Section C.6.a of the SRP.

RAI 280.18 (9.5.1.5)

In Section 9.5.1.5.6, the applicant indicates the use of manual fire alarm pull stations. The description associated with the fire detection/alarm system does not discuss the distribution of these devices or the coverage philosophy. Please describe the distribution and the philosophy behind the use of these devices.

Response 280.18 (9.5.1.5)

As stated in Section 9.5.1.5.6 of the CESSAR-DC, manual pull stations will be located as determined by the Fire Hazards Analysis. In this analysis, the life safety features will be carefully evaluated, and the distribution of the manual pull station will be consistent with the criteria outlined in NFPA 101, The Life Safety Code. As a minimum, manual pull stations will be provided in the vicinity of each exit stair on each elevation. Additional pull stations may be needed based on such factors as occupant load, fire hazard, and exit travel distance.

Question 280.19
(9.5.1.3)

Please explain how ventilation systems are designed to provide smoke control capabilities. The kinds of specific information required include:

- o use, if any, of smoke and/or fire dampers,
- o number of air changes per unit time when the HVAC system is operating in 100% exhaust mode.
- o HVAC pressure balance between an area with a fire and adjacent areas.

Response 280.19
(9.5.1.3)

The control building ventilation system is provided with separate outside air intakes for the control room separate from the remainder of the control complex including the remote shutdown room. Separate ductwork is utilized for the control room and the remote shutdown room to eliminate smoke migration between the two areas.

The Control Complex has a smoke control system which utilizes dedicated smoke exhaust fans, smoke dampers and 100% outside air supplied by the Control Complex air-handling units. The smoke purge fans are sized to exhaust three cfm per sq. ft. The smoke purge system is manually activated by the control room operator.

In the subsphere, electrical equipment rooms A, B, C and D on elevation 50+0 are separated by channel with 3 hour fire resistance barriers. The two channels within a division share a common ventilation system, but are separated by fire dampers. Smoke purge fans are utilized to prevent smoke migration from one channel to the other in the same division.

Smoke migration between divisions in the nuclear annex is prevented by providing a 3 hour fire resistance wall between divisions with all penetrations sealed to maintain the 3 hour fire resistance barrier. No HVAC ducts will penetrate the division wall. Separate HVAC systems are provided for each side of the divisionally separated building. The stairwells are pressurized to prevent smoke from entering and migrating between elevations.

The number of air changes per hour when the HVAC system is operating in 100% exhaust mode will be determined for all fire zones during the detailed design phase. Exact changeover rates are calculated once specific component characteristics are known, however, typical changeover rates for occupied areas are in the range of approximately 3-4 changes/hour. For generally unoccupied areas the changeover rate would be in the range of approximately 1-3 changes/hour based on exhaust fans with about 3 cfm/ft^2 capacity. The ventilation systems handle smoke purge by isolation of supply air in the area in which the fire occurred. The normal exhaust system for the area will purge the smoke providing a slight negative pressure to the area in relation to surrounding areas still receiving supply air. The exhaust filter unit is bypassed in the smoke purge mode. This mode of operation is manually activated by the control room. The recirculation cooling units in an area with smoke will need a maintenance check to see if the prefilter needs replacing and the cooling coils need to be cleaned after the smoke purge is completed.

This response is being incorporated into CESSAR-DC Section 9.5.1.3.3 in a future amendment. A markup of this section is attached for NRC review.

shields. In the course of detailed design and development of the Fire Hazards Analysis, it may be necessary to use these materials to assure fire safety in accordance with the Standard Review Plan. If necessary, fire rated insulating material will be rated in accordance with ASTM E119 for architectural features. Components which may be protected by fire rated insulating material include structural steel, redundant safety related cables, and safety related components.

Electrical components protected by fire insulating material have ampacity derated based on insulating material property.

9.5.1.3.3 Isolation/Containment of Flames, Heat, Smoke, and Hot Gases

Isolation/containment of fire and products of combustion are achieved by implementing elements of the defense-in-depth concepts.

The System 80+ minimizes the available quantity of combustible material by use of fiber optic cable which reduces the number of control and signal cables (by an estimated order of magnitude from that which would otherwise be required). Equipment location and separation by fire barriers as stated above serves to provide inherent containment of fire spread. Penetrations in fire barriers are designed to contain combustion products as well as prevent fire spread. Ventilation systems are designed to provide smoke control capabilities which are necessary to preclude the possibility of redundant safety related equipment from being damaged by fire and spread of products of combustion. The ventilation system for each area is arranged to ventilate products of combustion without spread to other areas. I

Insert 1

9.5.1.3.4 Interior Finish Materials

Interior wall and structural materials are classified as noncombustible or fire resistive.

Interior finish, thermal insulation, radiation shielding, and acoustical materials meet the following criteria in the installed configuration:

A. Flame spread of 25 or less

B. Fuel contribution of 50 or less

C. Smoke development of 100 or less

D. Minimum critical radiant flux of 0.45kw/cm^2

Insert 1

The control building ventilation system is provided with separate outside air intakes for the control room separate from the remainder of the control complex including the remote shutdown room. Separate ductwork is utilized for the control room and the remote shutdown room to eliminate smoke migration between the two areas.

The Control Complex has a smoke control system which utilizes dedicated smoke exhaust fans, smoke dampers and 100% outside air supplied by the Control Complex air-handling units. The smoke purge fans are sized to exhaust three cfm per sq. ft. The smoke purge system is manually activated by the control room operator.

In the subsphere, electrical equipment rooms A, B, C and D on elevation 50+0 are separated by channel with 3 hour fire resistance barriers. The two channels within a division share a common ventilation system, but are separated by fire dampers. Smoke purge fans are utilized to prevent smoke migration from one channel to the other in the same division.

Smoke migration between divisions in the nuclear annex is prevented by providing a 3 hour fire resistance wall between divisions with all penetrations sealed to maintain the 3 hour fire resistance barrier. No HVAC ducts will penetrate the divisional wall. Separate HVAC systems are provided for each side of the divisionally separated building. The stairwells are pressurized to prevent smoke from entering and migrating between elevations.

The ventilation systems handle smoke purge by isolation of supply air in the area in which the fire occurred. The normal exhaust system for the area will purge the smoke providing a slight negative pressure to the area in relation to surrounding areas still receiving supply air. The exhaust filter unit is bypassed in the smoke purge mode. This mode of operation is manually activated by the control room. The recirculation cooling units in an area with smoke will need a maintenance check to see if the prefilter needs replacing and the cooling coils need to be cleaned after the smoke purge is completed.

Question 280.20
(9.5.1.6)

What protection is provided for filters against fouling by smoke/soot with potential for failure due to excessive pressure drop across the filters.

Response 280.20
(9.5.1.6)

During the smoke purge mode of operation, the filter units are isolated and the smoke is bypassed around the filter units to the atmosphere. The smoke purge is manually activated by the control room after the fire is extinguished completely. Recirculation cooling units in the smoke filled area will need maintenance check to see if the prefilters need replacing and the cooling coils need to be cleaned after the smoke purge is completed.

Question 280.21
(9.5.1.6)

Are moisture separators required or provided upstream of charcoal and HEPA filter to protect them from potential damage due to water that may become entrained in the exhaust system?

Response 280.21
(9.5.1.6)

A moisture eliminator is provided in each exhaust filter unit upstream of the charcoal and HEPA filters to remove entrained particulate water in the airstream. Electric heaters are provided downstream of the moisture eliminators to vaporize the water particles not removed by the moisture eliminators.

This response will be incorporated into CESSAR-DC Section 9.5.1 in the next amendment. A markup of this section is attached for NRC review.

The smoke control design philosophy is to allow for smoke venting from any plant area without spreading to adjacent areas, to maintain plant habitability for operator protection and to ensure protection of the public. The containment, subsphere, fuel pool, nuclear annex and two diesel buildings are each served by 100% outside air and 100% exhaust ventilation systems.

Smoke control and exhaust is accomplished by aligning the ventilation to supply 100% outside air and to exhaust directly to the outside. Smoke and gases containing radioactive materials are routed through a filter train to the unit vent if a radioactive signal is received. The control complex has smoke exhaust fans to remove smoke from specific areas as determined by control operators utilizing signals from smoke detectors located in exhaust and return air ducts. The control operator aligns dampers to exhaust an area where fire occurs while isolating exhaust and return air in adjacent areas while supply dampers remain open to create a slight positive pressure in adjacent areas.

Insert 1 & 2

Fresh air intakes are located remote from the ventilation system exhaust to preclude the possibility of contaminating the intake air with products of combustion. I

Stairwells in the Nuclear Annex are individually pressurized with roof-mounted fans to preclude smoke infiltration.

Carbon and high energy particulate air (HEPA) do not represent a potential exposure fire hazard to nearby safety related components. Carbon, used in carbon filters, has a minimum ignition temperature of 625°F. HEPA filters have a minimum ignition temperature of 600°F. Normal heating system air temperature is about 105°F. If the air temperature approaches 200°F, carbon will begin to release any adsorbed radioactive iodine. If an air temperature excursion occurs in the safety related ventilation system with carbon or HEPA filters, the heat sensor will cut off the filter train fan and the redundant fan serving the redundant division will begin to serve the area involved; therefore, the fire will be isolated.

9.5.1.6.3 Curbs and Drains

Where fixed fire protection systems are installed, floor drains are provided, sized to collect water discharge. In areas where drains are not installed due to pressure boundary constraints, equipment susceptible to water damage is installed on six-inch elevated curbs.

Insert 1

During the smoke purge mode of operation, the filter units are isolated and the smoke is bypassed around the filter units to the atmosphere. The smoke purge is manually activated by the control room after the fire is extinguished completely. Recirculation cooling units in the smoke filled area will need a maintenance check to see if the prefilters need replacing and the cooling coils need to be cleaned after the smoke purge is completed.

Insert 2

A moisture eliminator is provided in each exhaust filter unit upstream of the charcoal and HEPA filters to remove entrained particulate water in the airstream. Electric heaters are provided downstream of the moisture eliminators to vaporize the water particles not removed by the moisture eliminators.

Question RAI 280.22

In Section 9.5.1.6.4, Reactor Coolant Pump Motor Oil Collection System, the description does not indicated if the reactor coolant pump oil collection drain tanks are provided with level indication which is alarmed and annunciated in the control room. Please discuss how the tank levels are monitored.

Response 280.22

The reactor coolant pump oil collection drain tanks will be provided with level indication which is alarmed and annunciated in the control room. A marked-up copy of Section 9.5.1.6 of CESSAR-DC is attached for review. This revision will be incorporated in a future CESSAR-DC update.

Floor drains installed in areas where radioactive material may be entrained in water discharge are routed to the radioactive water sump so that it can be analyzed and treated if necessary before release to the environment.

In areas containing combustible liquids, floor drains are designed with water seal traps so that burning liquids cannot flow into adjacent safety related areas through the drainage system.

9.5.1.6.4 Reactor Coolant Pump Motor Oil Collection System

Each reactor coolant pump motor contains about 250 gallons of oil used as a heat exchanger medium for motor cooling and for bearing lubrication. To preclude the potential for oil escaping from the motor, an oil collection shroud is installed. When combustible oil is used, the oil collection shroud is designed to withstand the design basis earthquake. Where fire resistant oil (similar to that commonly used in turbine governor control systems) is used, the system is not seismically qualified but is seismically restrained to prevent falling on other safety related equipment. The shroud encloses the upper and lower oil reservoirs and related piping so that any potential pressurized and nonpressurized leakage points are contained. The shroud is drained through a collection pipe to the reactor coolant pump motor oil drain tank, located in the lowest level of containment elevation 91+9. Each drain tank is located within a dike, sized to contain the full inventory of the motor oil. The vent for each tank has a flame arrestor to prevent the possibility of burning oil vapor propagating into the tank. Each tank will be provided with inventory level indication which is alarmed and annunciated in the control room. I

9.5.1.6.5 Fire Brigade Radios

The station radio system includes a dedicated frequency for fire brigade use. Dedicated radio units for fire brigade use are located in the fire brigade equipment storage room. Radios are stored in the charger base to assure they are fully charged when needed. The frequency is selected to assure that plant security communication and protective relay systems are not affected. There are an adequate number of units for at least five fire brigade members, leaders, and spare units for additional brigade members and operators.

The fire brigade radio system has fixed repeaters located so that fire brigade members can communicate with each other and the control room from any location of the plant. Fixed repeaters are located and wiring routed so that radio communication is available following fire in any area of the plant.

Question 280.23 (9.5.1.6)

Please specify that breathing air compressors are located in areas that are free of any airborne contaminants. In addition, please specify that breathing air compressors shall be oil free and shall conform to the appropriate OSHA requirements.

Response 280.23 (9.5.1.6)

Breathing air compressors are located in an area that is not susceptible to a fire in a safety related area, and that is free of airborne contaminants under normal conditions. The compressors shall be oil free or equipped with high-temperature and carbon monoxide alarms in accordance with OSHA Section 1910.134, Respiratory Protection.

A marked-up copy of Section 9.5.1.6.6 of CESSAR-DC is attached. This revision will be included in a future CESSAR-DC update.

and that is free of airborne contaminants under normal conditions. The compressor will be oil free or equipped with high temperature and carbon monoxide alarms in accordance with 29 CFR 1910.134 (OSHA) Section 1910.134, Respiratory Protection.

9.5.1.6.6 **Fire Brigade Breathing Air System**

Fire brigade personnel protective equipment includes breathing air cylinders. There is an adequate quantity of cylinders for each fire brigade member (and a quantity of spare cylinders as determined appropriate by the Fire Brigade Leader) located in the Fire Brigade Equipment Storage room. In addition, a breathing air compressor is provided in an area which would not be susceptible to fire in a safety related area~~, of the plant~~. The breathing air compressor is powered from the Alternate AC Source - Combustion Turbine. Power and control cables for the breathing air compressor are routed and protected to assure that fire in a safety related portion of the station which requires the use of fire brigade Self-Contained Breathing Air (SCBA) units will not interrupt operation of the breathing air compressor.

9.5.1.7 **Startup and Recurring System Tests and Inspections**

9.5.1.7.1 **Fire Pumps**

A. Acceptance Test Criteria

1. Hydrostatic Tests

Pump suction piping (except short lengths between suction tanks and pumps) and discharge piping (up to the pump discharge isolation valve) are pressure tested at 200 psi for two hours. Maximum allowable leakage is two quarts per hour per 100 gaskets or joints.

2. Performance Tests

Fire pumps are performance tested in accordance with NFPA 20, "Standard for Centrifugal Fire Pumps."

a. Pumps are tested at minimum flow, rated flow, and 150% of rated flow. Performance shall be within ± 5% of the manufacturer's characteristic performance curve for flow and pressure. Voltage shall be within 5% below or 10% above the rated nameplate voltage.

b. Pumps are started and brought up to speed without interruptions under rated flow conditions.

c. Fire pump controllers shall perform at least 10 automatic and 10 manual starts, with the pump driver operating for at least five minutes at full

I

Question 280.24

In Section 9.5.1.7.1, Fire Pumps, the applicant indicates that the hydrostatic test pressure for the suction and discharge piping is 200 psi. The static head of the pump may exceed 200 psi. The criteria recommended by NFPA 24 is static plus 50 psi. Please provide justification as to why this criteria is not being considered.

Response 280.24

It is expected that the static head or shut-off pressure of the fire pumps will not exceed 150 PSI. Sections 9.5.1.7.1 and 9.5.1.7.2 of the CESSAR-DC will be revised to require that the hydrostatic test pressure will be not less than 200 psi, or at 50 psi in excess of the maximum static pressure if the maximum static pressure is in excess of 150 psi. Marked-up copies of Sections 9.5.1.7.1 and 9.5.1.7.2 are attached. These revisions will be incorporated in a future CESSAR-DC update.

9.5.1.6.6 **Fire Brigade Breathing Air System**

Fire brigade personnel protective equipment includes breathing air cylinders. There is an adequate quantity of cylinders for each fire brigade member (and a quantity of spare cylinders as determined appropriate by the Fire Brigade Leader) located in the Fire Brigade Equipment Storage room. In addition, a breathing air compressor is provided in an area which would not be susceptible to fire in a safety related area of the plant. The breathing air compressor is powered from the Alternate AC Source - Combustion Turbine. Power and control cables for the breathing air compressor are routed and protected to assure that fire in a safety related portion of the station which requires the use of fire brigade Self-Contained Breathing Air (SCBA) units will not interrupt operation of the breathing air compressor.

9.5.1.7 Startup and Recurring System Tests and Inspections

9.5.1.7.1 **Fire Pumps**

A. Acceptance Test Criteria

1. Hydrostatic Tests

Pump suction piping (except short lengths between suction tanks and pumps) and discharge piping (up to the pump discharge isolation valve) are pressure tested at 200 psi, for two hours. Maximum allowable leakage is two quarts per hour per 100 gaskets or joints.

or at 50 psi in excess of the maximum static pressure if the maximum static pressure is in excess of 150 psi.

2. Performance Tests

Fire pumps are performance tested in accordance with NFPA 20, "Standard for Centrifugal Fire Pumps."

a. Pumps are tested at minimum flow, rated flow, and 150% of rated flow. Performance shall be within ± 5% of the manufacturer's characteristic performance curve for flow and pressure. Voltage shall be within 5% below or 10% above the rated nameplate voltage.

b. Pumps are started and brought up to speed without interruptions under rated flow conditions.

c. Fire pump controllers shall perform at least 10 automatic and 10 manual starts, with the pump driver operating for at least five minutes at full

e. Test relief valves for actuation at the proper setting.

f. Proper operation of the jockey pump unit is verified.

2. Weekly Tests

Pumps are tested weekly to assure automatic starting upon system pressure drop. The diesel engine driven pump runs for at least 15 minutes, and the motor driven pump operates at least five minutes without excessive vibration or leakage at the packing. Diesel fuel tank levels are checked to assure an adequate supply.

9.5.1.7.2 Water Distribution System

The water distribution system is tested in accordance with NFPA 24, "Standard for Private Fire Service Underground Mains."

A. Acceptance Tests

1. Hydrostatic Tests I

The water distribution system is hydrostatically tested at 200 psi, or at 50 psi in excess of the maximum static pressure if the maximum static pressure is in excess of 150 psi for at least two hours. Allowable leakage is up to 2 quarts per hour per 100 pipe joints.

2. Flow Tests

a. Flow tests are conducted to assure adequate and unobstructed flow through each flow path of the water distribution system. The minimum acceptable flow rates are as follows:

- 12 inch pipe 3520 gpm
- 10 inch pipe 2440 gpm
- 8 inch pipe 1560 gpm
- 6 inch pipe 880 gpm

These flow rates result in flow velocity of at least 10 feet per second.

Each fire hydrant is operated to assure that distribution piping is unobstructed.

b. Water flow is conducted through each flow path of the water distribution system to assure that the minimum calculated flow and pressure is available.

Question 280.25 (9.5.1.7)

In Section 9.5.1.7, Startup and Recurring System Tests and Inspections, the reoccurring tests described do not represent a consistent testing program which would meet the provisions of the tests recommended by current STS. As a minimum, these test should assure total system operability (i.e., testing of the battery for the diesel fire pumps, fire detection circuit testing, fire door testing, fire barrier testing, etc). Please provide a description of testing which will demonstrate full system function operability.

Response 280.25 (9.5.1.7)

Section 9.5.1.7 of CESSAR-DC is intended to give an overview of the required system tests and inspections. Detailed procedures will be developed prior to plant start-up, to demonstrate system functional operability and compliance with the STS.

Question 280.26 (9.5.1.9)

In Section 9.5.1.9.3, Fire Brigade Organization, Training, and Records, the proposed system is not consistent with the guidance provided in SRP Section C.3. Please provide additional information which assures that the training, drills, practice sessions, brigade equipment will meet that guidance of the SRP.

Response 280.26 (9.5.1.9)

Section 9.5.1.9 of CESSAR-DC will be expanded to include the following information.

Fire brigade members receive annual physical examination to assure ability to perform fire fighting activities.

Fire brigade members are provided with the following personnel protective equipment:

- Turnout coats
- Boots
- Gloves
- Helmets
- Self-contained breathing apparatus (SCBA) with full-face, positive pressure mask rated for 60 minute duration.

In addition, the fire brigade organization is provided with the following equipment:

- Breathing air compressor
- Radio communication system
- Portable battery powered lights
- Portable smoke purge fans
- Portable fire extinguisher
- Additional lengths of 21/2 inch and 11/2 inch fire hose with nozzles, couplings, fitting, gaskets, spanner wrenches, etc.
- Spare breathing air cylinders
- First aid kit

There are at least 10 SCBAs reserved for fire brigade use. Each has two 60-minute reserve cylinders. The breathing air compressor is powered from the station emergency power combustion turbine.

Fire brigade training consists of initial classroom and practical training. Initial classroom training consists of:

- Instruction concerning the fire fighting plan and member's responsibility.

- Review of the prefire plan which includes type and location of fire hazards.

- Instruction of potential effects of fire, flame, hot gases, and products of combustion.

- Familiarization with plant layout, equipment functions and potential hazards, location of fire protection equipment, location of power supply controls, operation of ventilation and smoke control systems, and access/-egress routes for each area.

- Use of available fire fighting equipment and correct method of fighting fires in energized electrical equipment, fires in cables, and cable trays, hydrogen fires and other types of flammable and combustible liquids, and fires involving ordinary combustible materials.

- Use of fire brigade radios, portable emergency lighting, smoke control equipment including portable smoke ejectors, and other manual fire fighting equipment.

- Procedures for fire attack in buildings and confined spaces.

- Instruction regarding fire fighting strategy for each fire area, room, or zone.

- Fire fighting activities are coordinated with the local volunteer fire department to assure adequate back-up fire fighting capability can be provided if necessary.

- Operational precautions for fighting fire on nuclear power sites including radiological protection and special hazards associated with a nuclear power plant.

Refresher and requalification training consists of the following activities:

- Meetings with the local fire department (if any) are held annually to review significant plant modifications and changes to fire fighting strategies.

- Periodic refresher training sessions are held so that each brigade member participates in training at least every two years.

- Practice sessions are held for each brigade member in proper fire fighting techniques and use of fire brigade equipment. Each fire brigade member participates in at least one drill per year.

- Drills are performed in the plant at least once per quarter for each shift. Each fire brigade member participates in at least two drills per year. At least one drill per year, per shift, is unannounced, and at least one drill per year for each shift occurs on the back shift. At least once per year, the local fire department (if any) participates in station drills.

- At least every three years, drills are critiqued by qualified individuals independent of the corporate staff.

- Drill critiques include: fire alarm effectiveness, time required for notification, fire brigade response, fire fighting strategies, use of fire fighting equipment and suppression techniques, assessment of members' knowledge of roles and equipment use, and strategies and equipment use.

Drill scenarios are based on realistic potential fire events in various areas of the plant. Scenarios include fire growth, effect on safety-related and safe shutdown functions, and availability of ventilation.

Records of fire brigade member physical examination, training drills, and critiques are maintained on file.

NFPA 600, "Standard for Private Fire Brigades" is used as guidance in organization and training of the fire brigade.

A marked-up copy of Section 9.5.1.9.3 of CESSAR-DC is attached. This revision will be included in a future CESSAR-DC update.

9.5.1.9.2 Personnel Qualifications

A. Fire Protection Engineer

The individual responsible for developing and implementing the overall fire protection program is designated as the Fire Protection Engineer. The Fire Protection Engineer is a Registered Professional Engineer and graduate of an accredited engineering curriculum with at least six years of engineering experience, three of which have been in responsible charge of fire protection engineering activities.

B. Fire Chief

The individual designated as Fire Chief has certification as a firefighter training instructor. In addition, the Fire Chief has experience in organizing, instructing, training, drilling, and critiquing an industrial fire brigade.

C. Fire Brigade Members

Fire brigade members have completed an initial 40 hours training consisting of a 40-hour course which includes classroom instruction and practical fire fighting training. Each member has passed a physical examination to assure ability to participate in fire brigade activities. I

Fire brigade members receive annual requalification training and physical examination.

D. Fire Protection System Operation, Testing, and Maintenance

Functional groups responsible for fire protection system operation, maintenance, and testing are qualified by training and experience and understand functions of the system.

9.5.1.9.3 Fire Brigade Organization, Training, and Records

The plant fire brigade is fully qualified for structural fire fighting. There are at least five fire brigade members on duty at all times. ~~Fire brigade members receive initial and annual physical examinations. Initial training consists of 40 hours (24 hours classroom and 16 hours practical training). Requalification training consists of eight hours per quarter classroom training and 16 hours of practical training annually. In-plant fire drills are conducted quarterly. Annual training is conducted with the local fire department to assure a coordinated response if fire department assistance is required.~~

Place Insert "A" here.

PLACE INSERT "B" HERE

The station prefire plan details fire fighting strategies for each area of the station including known hazards, location of fire fighting equipment, location of controls for power supply and ventilation systems, and other pertinent information.

~~Records of fire brigade member qualification and training are maintained on file for review.~~

9.5.1.10 Fire Hazards Analysis

A Fire Hazards Analysis is conducted for each room area or zone of the plant. Containing safety related equipment or equipment important to safety. It considers the function of major equipment in the area, location and number of redundant equipment or functions, known and anticipated quantity and configuration of combustible material, ventilation and smoke control, presences of predetermined fire protection features, and consequences of fire with and without fire protection features functioning properly. Where the Fire Hazards Analysis determines that Design Objectives are met in accordance with Section 9.5.1.1, fire protection is considered adequate.

9.5.1.11 Fire Protection Quality Assurance Program

The Fire Protection Quality Assurance Program implements a "graded" approach focusing attention to features that assure that design, procurement, installation, testing, operation, maintenance, and repair are conducted as appropriate. The program assures that systems, equipment, components, and procedures produce the fire protection function as intended. The program complies with the intent of NUREG 0800, Section 9.5.1, "Standard Review Plan." I

The program applies to features addressed in the Fire Hazards Analysis as follows:

A. Features provided to separate or protect redundant systems and equipment required to achieve cold shutdown.

B. Features which provide defense-in-depth for protection of safety related systems, equipment, and components.

Program objectives are to assure that fire protection features, including mechanical and electrical systems, fire barrier components and fire insulating material, are properly designed, installed, operated, and maintained in accordance with regulatory requirements, industry standards, and National Fire Protection Association codes and standards. Objectives are achieved as follows:

CESSAR-DC SECTION 9.5.1.4.3 INSERT "A"

Fire brigade members receive annual physical examinations to assure ability to perform fire fighting activities.

Fire brigade members are provided with the following personnel protective equipment:

- Turnout coats
- Boots
- Gloves
- Helmets
- Self-contained breathing apparatus (SCBA) with full-face, positive pressure mask rated for 60 minute duration.

In addition, the fire brigade organization is provided with the following equipment:

- Breathing air compressor
- Radio communication system
- Portable battery powered lights
- Portable smoke purge fans
- Portable fire extinguisher
- Additional lengths of 21/2 inch and 11/2 inch fire hose with nozzles, couplings, fitting, gaskets, spanner wrenches, etc.
- Spare breathing air cylinders
- First aid kit

There are at least 10 SCBAs reserved for fire brigade use. Each has two 60-minute reserve cylinders. The breathing air compressor is powered from the station emergency power combustion turbine.

Fire brigade training consists of initial classroom and practical training. Initial classroom training consists of:

- Instruction concerning the fire fighting plan and member's responsibility.

- Review of the prefire plan which includes type and location of fire hazards.

- Instruction of potential effects of fire, flame, hot gases, and products of combustion.

- Familiarization with plant layout, equipment functions and potential hazards, location of fire protection equipment, location of power supply controls, operation of ventilation and smoke control systems, and access/-egress routes for each area.

- Use of available fire fighting equipment and correct method of fighting fires in energized electrical equipment, fires in cables, and cable trays, hydrogen fires and other types of flammable and combustible liquids, and fires involving ordinary combustible materials.
- Use of fire brigade radios, portable emergency lighting, smoke control equipment including portable smoke ejectors, and other manual fire fighting equipment.
- Procedures for fire attack in buildings and confined spaces.
- Instruction regarding fire fighting strategy for each fire area, room, or zone.
- Fire fighting activities are coordinated with the local volunteer fire department to assure adequate back-up fire fighting capability can be provided if necessary.
- Operational precautions for fighting fire on nuclear power sites including radiological protection and special hazards associated with a nuclear power plant.

Refresher and requalification training consists of the following activities:

- Meetings with the local fire department are held annually to review significant plant modifications and changes to fire fighting strategies.
- Periodic refresher training sessions are held so that each brigade member participates in training at least every two years.
- Practice sessions are held for each brigade member in proper fire fighting techniques and use of fire brigade equipment. Each fire brigade member participates in at least one drill per year.

- Drills are performed in the plant at least once per quarter for each shift. Each fire brigade member participates in at least two drills per year. At least one drill per year, per shift, is unannounced, and at least one drill per year for each shift occurs on the back shift. At least once per year, the local fire department participates in station drills.

- At least every three years, drills are critiqued by qualified individuals independent of the corporate staff.

- Drill critiques include fire alarm effectiveness, time required for notification, fire brigade response, fire fighting strategies, use of fire fighting equipment and suppression techniques, assessment of members' knowledge of roles and equipment use, and strategies and equipment use.

CESSAR-DC SECTION 9.5.9.3 INSERT "B"

Drill scenarios are based on realistic potential fire events in various areas of the plant. Scenarios include fire growth, effect on safety-related and safe shutdown functions, and availability of ventilation.

Records of fire brigade member physical examination, training drills, and critiques are maintained on file.

NFPA 600, "Standard for Private Fire Brigades" is used as guidance in organization and training of the fire brigade.

Question 410.32.c

The response to question 410.32.c implies that the floor drain and sump pumps supply flood protection for all safety related systems. However, in Sections 9.3.3 and 9.4.9, only the reactor subsphere and diesel generator sump pump systems were identified as being safety related and providing some measure of flood protection. The floor drain system (including system instrumentation) for other areas containing safety related systems were not identified as providing flood protection and were, therefore, not identified as safety related equipment. Provide information to resolve this apparent discrepancy between the information contained in Chapters 3 and 9.

Response 410.32.c

The reactor building subsphere and diesel generator building are protected from flood with redundant Safety Class 3 sump pumps and associated instrumentation. Safety Class 3 back flow check valves are also utilized in the equipment and floor drainage system where necessary to prevent back flow of flood waters into safety-related areas. The System 80+™ design incorporates additional flood protection features to protect other areas of the plant containing safety-related systems and equipment. In addition to the features already given in CESSAR-DC Section 3.4.4, various other flood protection methods will be added to this section in response to NRC RAI 410.98. The response to NRC RAI 410.98 provides a discussion of internal flood protection methods which are utilized in the System 80+™ design. This information will be included in a future amendment to CESSAR-DC.

Question 410.32.g

Table 3.2-4 was identified (in response to question 410.32.g) as providing a list of structures to be flood protected. However, this table does not specifically identify which of the structures listed will be designed using flood loading criteria.

Response 410.32.g

Section 3.4.4.1 identifies Seismic Category 1 structures as requiring flood protection. Section 3.4.4.1 will be amended to reference Table 3.2-1 to identify Seismic Category I structures.

Table 3.2-4 does not identify structures requiring flood protection as identified in the previous response to RAI 410.32.g.

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RESPONSE TO NRC RAI 410.32(g)

3.4 WATER LEVEL (FLOOD) DESIGN

All Seismic Category I structures, components and equipment are designed for applicable loadings caused by postulated floods. Section 2.4 of the site-specific SAR describes, in detail, the relationship of the site-specific flood levels to safety-related buildings and facilities.

3.4.1 FLOOD ELEVATIONS

The elevation level for floods at the reactor site is determined in accordance with Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants," and ANSI/ANS 2.8-1983, "Determining Design Basis Flooding at Power Reactor Sites." The design basis level for the System 80+ Standard Design is limited to 1 foot below plant finished yard grade as the minimum flood level value. The maximum flood level value is site-specific and protection measures for that flood level are described in Section 2.4 of the site-specific SAR.

3.4.2 PHENOMENA CONSIDERED IN DESIGN LOAD CALCULATION

All safety-related structures of the reactor building complex are designed to withstand the static and dynamic forces of the plant flood level. Other safety-related structures or systems essential for plant operation are designed for the site-related flood level as described in Section 2.4 of the site-specific SAR. D

3.4.3 FLOOD FORCE APPLICATION

The design flood is used in determining the applicable water level for design of all Seismic Category I structures in accordance with the load combinations discussed in Section 3.8.4. The forces acting on those structures are determined on the basis of full external hydrostatic pressure corresponding to that flood level. All Seismic Category I structures will be in a stable condition due to both moment and uplift forces resulting from the proper load combinations, including design basis flood levels.

3.4.4 FLOOD PROTECTION

3.4.4.1 Flood Protection Measures for Seismic Category I Structures

The flood protection measures for Seismic Category I structures, systems and components are designed in accordance with Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants." ~~The following structures and systems in the reactor complex area are designed for flood level protection:~~ SEISMIC CATEGORY I STRUCTURES IDENTIFIED IN TABLE 3.2-1 ARE DESIGNED FOR FLOOD PROTECTION.

ALWR-346

RESPONSE TO NRC RAI 410.32(g)

DELETE

- Reactor Building
- Diesel Generator Buildings
- Control Building
- Fuel Building
- Auxiliary Building

These safety-related structures are designed to maintain a dry environment during all floods by incorporating the following safeguards into their construction:

A. No exterior access openings will be lower than 1 foot above plant grade elevation.

B. The finished yard grade adjacent to the safety-related structures will be maintained at least 1 foot below the ground floor elevation. D

C. Waterstops are used in all horizontal and vertical construction joints in all exterior walls up to flood level elevation.

D. Water seals are provided for all penetrations in exterior walls up to flood level elevation.

E. Waterproofing of walls subject to flooding is provided. I

For other safety related structures where flood protection measures are required (e.g. pumping systems, stoplogs, watertight doors, dikes, retaining walls and drainage systems) the design of means for providing such protection will be described in Section 2.4 of the site-specific SAR. D

Redundant equipment is separated and compartmentalized so that a single flooding event does not affect redundant safety systems. Equipment such as the auxiliary shutdown panels are elevated off the floor so that flooding events will not affect these important pieces of equipment. I

3.4.4.2 Permanent Dewatering System

A permanent safety grade dewatering system will be installed to maintain the groundwater table at or below elevation 40 + 0. For sites where the groundwater table is at or below the foundation, the system is not required.

ALWR-346

RESPONSE TO NRC RAI 410.33(F)

3.5 MISSILE PROTECTION

The missile protection design for Seismic Category I structures, systems and components is described in this section.

Missile protection or redundancy is provided for Seismic Category I equipment and components such that internal and external missiles will not cause the release of significant amounts of radioactivity ~~or prevent the safe and orderly shutdown of the reactor.~~ SEISMIC CATEGORY I SYSTEMS AND STRUCTURES ARE IDENTIFIED IN TABLE 3.2-1

~~The protection of essential structures, systems~~ and components will be accomplished by one or more of the following: D

A. Minimizing the sources of missiles by equipment design features that prevent missile generation.

B. Orientation or physical separation of potential missile sources away from safety-related equipment and components.

C. Containment of potential missiles through the use of protective shields and barriers near the source.

D. The hardening of safety-related equipment and components to withstand missile impact, where such impacts cannot be reasonably avoided by the methods above. I

3.5.1 MISSILE SELECTION AND DESCRIPTION

Potential missiles are identified and characterized by type and source and their probability of occurrence, retention and impact. For equipment with energy sources capable of creating a missile, the selection is based on the application of a single-failure criterion to the retention features of the component. Where sufficient retention redundancy is provided in the event of a failure, no missile is postulated. D

Internally generated missiles can be generated potentially from two types of equipment: rotating components and pressurized components. Rotating components include turbine wheels, fans, auxiliary pumps and their associated motors. Pressurized components include valves, heat exchangers, vessels and their associated components.

Question 410.33

The response to RAI 410.33 and 410.36-39 should be fully incorporated into the CESSAR-DC text.

Response 410.33

The responses to the referenced RAIs are addressed as described below.

410.33(A)

The response is incorporated as shown in the attached markup.

410.33(B) and 410.33(E)

C-E has not added subsections to section 3.5.1.1 to address the types of missiles in this RAI due to the low energy of such missiles.

410.33

Please consider the response to this RAI to be revised as follows: As discussed with the NRC at the November 26, 1991 meeting on piping, seismic, and structural issues, the trains of safety systems outside containment are physically separated such that safe shutdown can always be achieved for a given accident using other trains. Therefore, major piping system layouts will be generated to verify plant arrangements (and they will be available for audit), but those envelopes are not intended for inclusion in CESSAR-DC for safety evaluation.

410.33(D)

This response was incorporated in Amendment I.

410.33(F)
Replace response with:

All Seismic Category I systems and structures require protection from internal and external missiles as stated in CESSAR-DC Section 3.5. CESSAR-DC Section 3.5 will be amended to reference Table 3.2-1 to identify Seismic Category I structures, systems and components.

410.39
Amended as follows:

Replace first sentence of the previous RAI response with the following two sentences: Table 3.2-1 identifies the Seismic

Category I structures. Table 3.2-4 summarizes the loading criteria for structures. These tables are already in CESSAR-DC.

In the last sentence "Table 3.5.1-4" should read "Table 3.5-2", which is already in CESSAR-DC.

410.36, 410.37 and 410.38

The response will be fully incorporated, as shown in the attached markups.

(and 200°F, see 3.6.1.1.2)

D. Industry pump designs are such that (and service history shows) no occurrences of impeller pieces penetrating pump casings.

3.5.1.1.2 **Valves**

There are no missiles postulated from valves for the following reasons:

A. All valve stems are provided with a backseat or shoulder larger than the valve bonnet opening.

B. Motor operated and manual valve stems are restrained by stem threads.

C. Operators on motor, hydraulic and pneumatic operated valves prevent stem ejection.

D. Pneumatic operated diaphragms and safety valve stems are restrained by spring force.

E. All valve bonnets are either pressure sealed, threaded or bolted such that there is redundant retention for prevention of missile generation.

D

3.5.1.1.3 **Pressure Vessels**

All pressurized vessels are considered moderate energy (275 psig) or less and are designed and constructed to the standards of the ASME Code. In addition to the ASME Code examination and testing requirements, all vessels will receive periodic in-service inspections. Where appropriate, these components are provided with pressure relief devices to ensure that no pressure buildup will exceed material design limits.

On this basis, moderate energy pressure vessels are not considered credible missile sources.

3.5.1.2 <u>Internally Generated Missiles (Inside Containment)</u>

Table 3.5-1 lists postulated missiles from equipment inside containment, and summarizes their characteristics. Included are major pretensioned studs and nuts, instruments, and the CEDM missile. Other items which were considered and specifically excluded because of redundant retention features are valve stems, valve bonnets and pressurized cover plates. Insert A

Insert B

Section 3.5.1.2 - Insert A

Question 410.36:

The third sentence on page 3.5-3, starting with "Other items which..." is not clear. Provide additional information that will clarify this statement.

Response 410.36:

There are no missiles postulated for valve stems, valve bonnets, and pressurized cover plates because sufficient retention redundance is provided by the following features:

1. All valve stems are provided with a backseat or shoulder larger than the valve bonnet opening.

2. Motor operated and manual valve stems are restrained by stem threads.

3. Operators on motor, hydraulic and pneumatic operated valves prevent stem ejection.

4. Pneumatic operated diaphragms and safety valve stems are restrained by spring force.

5. All valve bonnets and pressurized cover plates are either pressure sealed, threaded or bolted such that there is redundant retention for prevention of missile generation.

Section 3.5.1.2 - Insert B

~~Question 410.37:~~

~~Provide an assessment of the potential gravitational missiles generated inside containment and credible secondary missiles generated as a result of impact with primary missiles.~~

~~Response 410.37:~~

All non-safety related equipment inside containment is evaluated for its potential interaction with safety systems. Potential gravitational missiles are evaluated for impact and are anchored as necessary to prevent loss of function of safety systems caused by interaction with non-safety equipment.

Potential secondary missiles, such as concrete spalling, are evaluated for impact on safety systems and equipment. When necessary, protective structures are added to prevent interaction of secondary missiles with safety systems.

~~The response above is being added to CESSAR-DC, Section 3.5.1.2.~~

shields and barriers that will be designed for tornado missile effects. Tornado-generated missiles considered in the design are given in Table 3.5-2.

Insert C

3.5.1.5 Missiles Generated by Events Near the Site

Justification will be provided in the site-specific SAR.

3.5.1.6 Aircraft Hazards

Justification will be provided in the site-specific SAR. Also refer to Section 2.2.1.

3.5.2 STRUCTURES, SYSTEMS, AND COMPONENTS TO BE PROTECTED FROM EXTERNALLY GENERATED MISSILES

Tornado missiles are the design basis missiles from external sources. All safety related systems, equipment and components required to safely shut the reactor down and maintain it in a safe condition are housed in Category I structures designed as tornado resistant (see Section 3.5.1.4) and as such are considered to be adequately protected.

3.5.3 BARRIER DESIGN PROCEDURES

Missile barriers, whether steel or concrete, are designed with sufficient strength and thickness to stop postulated missiles and to prevent overall damage to Seismic Category I structures. The procedures by which structures and barriers are designed to perform this function are presented in this section.

3.5.3.1 Local Damage Prediction

The prediction of local damage in the immediate vicinity of an impacted area depends on the basic material of construction of the barrier itself (i.e. either concrete or steel). Corresponding procedures are discussed separately below.

3.5.3.1.1 Concrete Structures and Barriers

Local damage prediction for concrete structures includes the estimation of the depth of missile penetration and an assessment of whether secondary missiles might be generated by spalling. Generally, the Modified Petry Formula or the Modified NDRC Formula (References 2 and 3) is used to estimate missile penetration with appropriate constants taken from available test data. To insure that no secondary missiles (due to spalling) are generated, a minimum barrier thickness of 3 times the penetration depth is provided. Depending on certain missile characteristics, additional penetration formulas may be employed as justified by full scale impact tests (References 3 and 4).

Page 3.5-5 - Insert C

Question 410.38:

The details and references for the tornado-missile analysis were not identified in Section 3.5.1.4. Please discuss the compliance of the analysis with the Regulatory Guides (RG) 1.76, 1.117, and postulate missiles as required by the SRP.

In addition, this section cannot be reviewed completely until the completion of Table 3.2-1.

Response 410.38:

The guidance from Regulatory Guide 1.76 for Region 1 is used. Tornado missiles are in accordance with SRP 3.5.1.4 Spectrum II. Missile impacts are in accordance with SRP 3.5.3 and ACI 349, Appendix C. The minimum shield wall thickness is in accordance with Table 1 of SRP 3.5.3. Missiles will not penetrate the shield building. Missile loads are combined with tornado wind and pressure differentials. Non-Category I structures are not assumed to shield the reactor building or other Category I structures from tornado wind or missiles.

~~Section 3.5.1.4 and Table 3.2-1 were revised via Amendment I.~~

Question 410.97

Provide a discussion of how the Cooling Watar System Structures are to be flood protected or provide a set of flood protection interface criteria for those structures not within the CESSAR design scope.

Response 410.97

All Seismic Category I structures, systems and components that are listed in Table 3.2-1 require flood protection. Seismic Category I structures that are outside of the CESSAR-DC design scope are included. All Seismic Category I structures are flood protected as described in Section 3.4.4.1.

Question 410.98

An internal flood protection discussion is not provided in section 3.4. Reference is made to discussions in Section 9.3.3. However, this section discusses only piping related failures; a discussion of tank related failures provided in response to a separate RAI was not incorporated into the text of the CESSAR-DC. Provide in Section 3.4 a discussion of the internal flood protection methods to be utilized in the design.

Response 410.98

A discussion of internal flood protection methods has been added to Section 3.4. The attached revisions will be included in a future amendment to CESSAR-DC.

- Nuclear Annex
- Reactor Building
- Diesel Generator Buildings
- Control Building
- Fuel Building
- Auxiliary Building

These safety-related structures are designed to maintain a dry environment during all floods by incorporating the following safeguards into their construction:

A. No exterior access openings will be lower than 1 foot above plant grade elevation.

B. The finished yard grade adjacent to the safety-related structures will be maintained at least 1 foot below the ground floor elevation. D

C. Waterstops are used in all horizontal and vertical construction joints in all exterior walls up to flood level elevation.

D. Water seals are provided for all penetrations in exterior walls up to flood level elevation.

E. Waterproofing of walls subject to flooding is provided. I

For other safety related structures where flood protection measures are required (e.g. pumping systems, stoplogs, watertight doors, dikes, retaining walls and drainage systems) the design of means for providing such protection will be described in Section 2.4 of the site-specific SAR. D

INSERT 1

Redundant equipment is separated and compartmentalized so that a single flooding event does not affect redundant safety systems. Equipment such as the auxiliary shutdown panels are elevated off the floor so that flooding events will not affect these important pieces of equipment. I

3.4.4.2 Permanent Dewatering System

A permanent safety grade dewatering system will be installed to maintain the groundwater table at or below elevation 40 + 0. For sites where the groundwater table is at or below the foundation, the system is not required.

Attachment to letter ALWR- RAI 410.98

INSERT 1

Flood protection has been integrated in the System 80+ design. Initial considerations were towards eliminating or minimizing possible flood sources. For example, Service Water is located outside the Nuclear Annex to eliminate unlimited sources of water. Component Cooling Water and Emergency Feedwater are fully separated by division, thus eliminating the possibility of a single flood source within these systems impacting both divisions.

Protection from external flooding is provided by elevated building entrances. Secondary flooding sources located in the Turbine Building are confined to that building. Entrances to the Nuclear Annex from the Turbine Building are elevated to prevent flood propagation.

Lengths of high energy and moderate energy piping have been minimized by equipment location. Equipment is located in quadrants around the spherical containment to minimize the lengths of piping runs. The subsphere provides further close proximity of equipment to reduce piping runs from containment.

Flood barriers have been integrated into the design to provide further flood protection while minimizing the impact on maintenance accessibility. The primary means of flood control in the Nuclear Annex is provided by the divisional structural wall which serves as a barrier between redundant divisions of safe shutdown systems and components. At the lowest elevation this structural wall contains no doors or passages, and the limited penetrations through the wall are sealed.

Each half of the subsphere is compartmentalized to separate redundant safe shutdown components to the extent practical, while maintaining accessibility requirements. The subsphere, which houses the front line safety systems is compartmentalized into quadrants, with two quadrants on either side of the divisional structural wall. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability. Emergency Feedwater pumps are located in separate compartments within the quadrants with each compartment protected by flood barriers. Flood barriers also provide separation between electrical equipment and fluid mechanical systems at the lowest elevation within the Nuclear Annex. Curbs provide similar separation at higher elevations.

Flood protection is incorporated into the component cooling water heat exchanger building and station service water structures. These structures are divisionally separated by walls such that a flood in one division can not flood the other division.

Flood protection is also integrated into the floor drainage systems. The floor drainage systems are separated by division and safety Class 3 valves prevent backflow of water to areas containing safety related equipment. Each subsphere quadrant contains its own separate safety class 3 sump and associated instrumentation, which is powered from the diesel generators in the event of loss of offsite power.

The Diesel Generator Building floor drain sump pumps and associated instrumentation are safety class 3 to prevent flooding of the diesel generators. These pumps are also powered from the diesel generator in the event of loss of offsite power.

The Nuclear Annex has its own divisionally separated floor drainage system, having no common drain lines between divisions. Floors are gently sloped to allow good drainage to the divisional sumps.

Question 410.99

With regard to the missiles identified in Table 3.5-2.

a. For item b, the 6" Sch. 40 Pipe, the impact area should read 5.58 instead of 34. Only the steel area of the pipe should be considered as the impact area.

b. For item e, the 12" Sch. 40 Pipe, the impact area should read 15.74 instead of 125, Again only the steel area of the pipe should be considered as the impact area.

Response 410.99

Local and overall response effects are considered when designing a structural element for missile impact. Local damage prediction is discussed in CESSAR-DC Section 3.5.3.1. Overall damage prediction is discussed in CESSAR-DC Section 3.5.3.2.

Local damage may include penetration, perforation, scabbing and/or "punching" shear in the region of the impact on the structure. Overall response includes flexure and reaction shear in the structure.

Empirical formulas have been developed to evaluate the local missile impact effects for "hard" missiles. These empirical formulas generally do not apply for large deformable or "soft" missiles such as automobiles since they do not penetrate the structure and since they absorb some of the impact energy by deforming. Local effect of "soft" missiles are generally checked using "punching" shear criteria.

The evaluation of the overall response is generally based on energy/momentum balance or derivation of the impact forcing function, depending on the type of missile and target involved.

The definitions of terminology and variables of the assorted methods and formulas available to evaluate the effects of missile impact are not universally consistent. Care is taken to use terminology and variables (such as the impact area) consistent with the derivation of the methods and formulas used.

Since the definitions of terminology and variables are dependant on the type analysis and individual method and/or formulas used, CESSAR-DC Table 3.5-2 will be revised deleting the Impact Area information.

RAI 410-99

TABLE 3.5-2

DESIGN BASIS TORNADO MISSILES AND THEIR IMPACT VELOCITIES

Missile Descriptions	Dimensions (m)	Weight (lbs)	Impact Area (in²) (delete)	Design Impact Velocity (ft/sec) Horizontal	Vertical
A Wood Plank	0.092 x 0.289 x 3.66	115	41	272	191
B 6" Sch. 40 Pipe	0.168D x 4.58	287	34	171	119
C 1" Steel Rod	0.0254D x 0.915	8.8	0.79	167	167
D Utility Pole	0.343D x 10.68	1124	143	180	126
E 12" Sch. 40 Pipe	0.32D x 4.58	750	125	154	108
F Automobile	2 x 1.3 x 5	3990	4030	194	136

Missiles A, B, C, and E are to be considered at all elevations and missiles D and F at elevations up to 30 feet above all grade levels within 1/2 mile of the structure.

I

Question 410.100

With regard to the information in Table 3.2-4. Provide the function and location of the station test structure and justify why it is not tornado wind and missile protected.

Response 410.100

Station Test structure is a typographical error. This should be listed as Station Vent. CESSAR-DC will be revised to incorporate this change.

ALWR-346

RESPONSE TO NRC RAI 410.100

Attachment ALWR-346

TABLE 3.2-4

SUMMARY OF CRITERIA - STRUCTURES

Structures	Loading: Normal Wind	Dead and Equipment	E	Containment Accident Pressure	Seismic OBE	Seismic SSE	Tornado Wind	Tornado Missile	Remarks Including Any Environmental Requirements
Containment	-	X	A	X	X	X	-	-	Thermal Stresses; Equipment Missile Protected
Containment Interior Concrete	-	X	X	-	X	X	-	-	Differential Accident Pressure; Pipe Rupture Loads; Thermal Stresses; Equipment Missile Protected
Shield Building Including Foundation	X	X	X	-	X	X	X	X	Tornado Pressure Differential; Soil and Water Pressure
Containment Penetrations	-	X	X	X	X	X	-	-	Pipe Whipping
Containment Structural Steel	-	X	X	-	X	X	-	-	Thermal Stresses
Underground Cable Systems	X	X	X	-	X	X	-	-	
Station Service Water Pipe	X	X	X	-	X	X	X	X	Soil and Water Pressures or Buried Portion Hydraulic Pressures; Moving Equipment Loads
Station Service Water Structures Including Pump Structure, Intake & Discharge Structure, Dam, ~~Spillway Control Structure~~	X	X	X	-	X	X	X	X	Soil and Water Pressures; Seismic Analysis
NUCLEAR ANNEX ~~Auxiliary Building~~ Including ~~Control Building~~, Diesel Building, Fuel Pool, Main Steam and Feedwater Enclosures	X	X	X	-	X	X	X	X	Soil and Water Pressures on Substructure; Tornado Pressure Drop; Thermal Stresses and Cask Drop; Pipe and Pipe Rupture Loads;
Fuel Storage Racks	-	X	X	-	X	X	-	-	Thermal Stresses
Station ~~Test~~ VENT	X	X	X	-	X	X	-	-	

I

Amendment I
December 21, 1990

Question 410.110

a. The system P&IDs do not identify the class of piping and equipment which comprise the SSWS. The only class breaks provided on these P&IDs are the Class 3/Class 4 breaks at the vents. Provide additional piping and equipment classification identification on the P&IDs.

b. Plant layout drawings need to be provided to support the resolution of the following issues:

   - In order to assess the separation of redundant components from a common missile or pipe break hazard, plant layout drawings are to be reviewed to confirm that the SSWS pumphouse is constructed with walls between pumps of the same division, as well as between pumps of different divisions.

   - The plant layout drawings will also indicate if piping runs cross yards and this will allow the reviewer to assess the systems susceptibility to the freezing of piping.

c. Sheet 1 of Figure 9.2-1 identifies two valves that have been assigned the same number (i.e., SW-1356). A similar condition exists on Sheet 3 of Figure 9.2-3 with valve number SW-2356.

d. Similarly, Table 9.2.1-3 identifies butterfly valves SW-1356 and SW-2356 as "active valves" even though these valves are manually operated valves (i.e., have no operators). In addition, the table indicates that the safety position of valves SW-1356 and SW-2356 is open. These valves are upstream of the removed spool piece and an open position would only be acceptable subsequent to the re-installation of the spool piece.

e. Table 9.2.1-2 should be revised to provide design information on the SSWS heat exchangers. For example, the design heat duty (i.e., Btu/Hr), and shell and tube side data including inlet and outlet temperatures, flow and pressure.

Response 410.110

a. The equipment drain lines and the sump pumps with their associated piping and valves are Safety Class 4. The remaining portions of the Station Service Water System are Safety Class 3 with the exception of the Class 3/Class 4 breaks at the vents and the Class 3/Class 4 breaks at the isolation valves for the radiation monitors.

This response is being incorporated into CESSAR-DC Section 9.2.1, Station Service Water System. The response is reflected as note additions on each sheet of the Station Service Water System Flow Diagrams. A markup of CESSAR-DC Figure 9.2.1-1 is attached for NRC review.

b. Plant layout drawings of the Station Service Water System will not be provided for certification. The Station Service Water System layout is site-specific due to site-specific heat sink characteristics. However, as stated in CESSAR-DC Section 9.2.1.1.3, the Station Service Water System design conforms with General Design Criterion 4 in Appendix A of 10 CFR Part 50. This criterion states that structures, systems, and components important to safety shall be designed to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents. Also, it states that these structures, systems, and components shall be appropriately protected against missile or pipe break hazards. With respect to General Design Criterion 4, the Station Service Water System site-specific design shall provide adequate provisions to ensure system operation during all expected environmental conditions and shall provide adequate separation and barriers to preserve functional redundancy.

c. The repetition of valve numbers SW-1356 occurs on Sheet 2 of Figure 9.2.1-1 and the repetition of valve number SW-2356 occurs on Sheet 4 of Figure 9.2.1-1. The valve numbers of the valves upstream of the removable spool piece should be changed to SW-1359 on Sheet 2 of Figure 9.2.1-1 and SW-2359 on Sheet 4 of Figure 9.2.1-1.

This response is being incorporated into CESSAR-DC Section 9.2.1, Station Service Water System. This response is reflected on the Station Service Water System Flow Diagrams as valve number changes on the valves upstream of the removable spool pieces. A markup of CESSAR-DC Figure 9.2.1-1 is attached.

d. The butterfly valves upstream of the removable spool pieces are not active valves. Also, as indicated on Sheet 2 and Sheet 4 of Figure 9.2.1-1, these valves are normally closed. (Note: The valve numbers for these valves were changed as a result of the response to part (c) of NRC RAI 410.110.)

This response is being incorporated into CESSAR-DC Section 9.2.1, Station Service Water System. This response is reflected by the deletion of valves SW-1356 and SW-2356 from the active valve list (Table 9.2.1-3). A markup of Table 9.2.1-3 is attached.

e. The Station Service Water System provides station service water to the tube side of the Component Cooling Water Heat Exchanger. Heat is transferred from the component cooling water to the station service water through the Component Cooling Water Heat Exchangers. Design data for the shell and tube sides of the Component Cooling Water Heat Exchangers is contained in Table 9.2.2-4. Additional information is provided in an attached markup of Table 9.2.2-4.

TABLE 9.2.1-3

(Sheet 1 of 2)

ACTIVE VALVES, STATION SERVICE WATER SYSTEM

Valve Number	Safety Function	Valve Type	ASME Section III Code Class	Actuator Type
SW-100	Operate	Plug	3	Electric Motor
SW-101	Operate	Plug	3	Electric Motor
SW-102	Operate	Plug	3	Electric Motor
SW-103	Operate	Plug	3	Electric Motor
SW-104	Operate	Plug	3	Electric Motor
SW-105	Operate	Plug	3	Electric Motor
SW-106	Operate	Plug	3	Electric Motor
SW-107	Operate	Plug	3	Electric Motor
SW-108	Operate	Plug	3	Electric Motor
SW-109	Operate	Plug	3	Electric Motor
SW-110	Operate	Plug	3	Electric Motor
SW-111	Operate	Plug	3	Electric Motor
SW-120	Operate	Butterfly	3	Electric Motor
SW-121	Operate	Butterfly	3	Electric Motor
SW-122	Operate	Butterfly	3	Electric Motor
SW-123	Operate	Butterfly	3	Electric Motor
SW-1302	Operate	Swing Check	3	None
SW-1303	Operate	Swing Check	3	None
SW-1356	Open	Butterfly	3	None
SW-200	Operate	Plug	3	Electric Motor

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TABLE 9.2.1-3 (Cont'd)

(Sheet 2 of 2)

ACTIVE VALVES, STATION SERVICE WATER SYSTEM

Valve Number	Safety Function	Valve Type	ASME Section III Code Class	Actuator Type
SW-201	Operate	Plug	3	Electric Motor
SW-202	Operate	Plug	3	Electric Motor
SW-203	Operate	Plug	3	Electric Motor
SW-204	Operate	Plug	3	Electric Motor
SW-205	Operate	Plug	3	Electric Motor
SW-206	Operate	Plug	3	Electric Motor
SW-207	Operate	Plug	3	Electric Motor
SW-208	Operate	Plug	3	Electric Motor
SW-209	Operate	Plug	3	Electric Motor
SW-210	Operate	Plug	3	Electric Motor
SW-211	Operate	Plug	3	Electric Motor
SW-220	Operate	Butterfly	3	Electric Motor
SW-221	Operate	Butterfly	3	Electric Motor
SW-222	Operate	Butterfly	3	Electric Motor
SW-223	Operate	Butterfly	3	Electric Motor
SW-2302	Operate	Swing Check	3	None
SW-2303	Operate	Swing Check	3	None
~~SW-2356~~	~~Open~~	~~Butterfly~~	~~3~~	~~None~~

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TABLE 9.2.2-4

(Sheet 1 of 2)

SYSTEM COMPONENT DESIGN PARAMETERS

Component Cooling Water Pumps

Number	4
Design Code	ASME III, Class 3
Type	Centrifugal, Horizontal Split
Design Pressure	150 psig
Design Temperature	200°F
Material of Construction	Carbon Steel Casing Stainless Steel Impeller

Component Cooling Water Heat Exchangers

Design Heat Load	78.98 × 10⁶ Btu/hr (Normal Operation)
Number	4
Design Code	ASME III, Class 3
Type	Shell and Tube, Fixed Tubesheet
Shell -	
Fluid	Component Cooling Water
Design Pressure	150 psig
Design Temperature	200°F
Shell Temperature - Out	
Normal Operation	105°F
LOCA (initial heat load on CS)	120°F
Initial shutdown cooling	120°F
Final shutdown cooling	105°F
Fouling Factor	0.0005
Number of Passes	1
Material of Construction	Carbon Steel
Tube -	
Fluid	Station Service Water
Number of Passes	1
Design Pressure	150 psig
Design Temperature	200°F
Tube Temperature In	95°F
Fouling Factor	Dependent on Site Specific Station Service Water Chemistry
Material of Construction	Dependent on Site Specific Station Service Water Chemistry
Design Flow	14500 gpm
Design Flow	13019 gpm

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Question 410.111

a. The CESSAR should provide a justification that a pipe break in the non-essential portion of the CCWS (e.g., downstream of CC-102 or CC-202) would not adversely threaten the integrity of safety related components and systems which could be affected by flooding which results from the break (i.e., due to CCW Surge Tank inventory release).

b. Similar to Question 1 above, the CESSAR should address more fully the ramifications associated with the failure of the single isolation valve to the non-essential portion of the system.

c. The following issues should be addressed in the CESSAR:

   - The use of a check valve as a containment isolation valve (e.g., valves CC-1507 and CC-2507) requires justification within the CESSAR text.

   - The Class 2 motor-operated isolation valve on the Surge Tanks will fail open as indicated on the CESSAR figures. The line on which this valve is installed is a Class 4 line indicating it could not be expected to survive a seismic event. Could this jeopardize the inventory in the surge tank?

   - Similarly, could the failure of the non-seismic Class 4 overflow line from the CCW Surge Tank to the CCW Sump adversely impact the inventory in the surge tank in a seismic event?

d. The CESSAR should address the ability of the CCWS surge tanks to maintain a continuous water supply to the essential portions of the CCWS assuming a break in the non-seismic portions of the non-essential piping and the failure to isolate of valves CC-102 and CC-202. This discussion should include an analysis of the time to manually isolate these valves and/or to the time necessary to install the SSWS spool piece.

e. Table 9.2.2-4 should be revised to identify the design volume of the surge tanks to allow for an evaluation of the adequacy of this volume.

f. Figure 9.2.2-1 should also be revised to identify the interface between the CCWS and the Demineralized Water System. While the Demineralized Water system is the primary makeup system, it is not reflected on the CESSAR figures.

g. Section 9.2.2.2.2.6, "Loss Of Offsite Power," should be revised to more specifically address the response of the

CCWS to a loss of offsite power event (e.g., by assuming a two-hour or eight-hour LOOP). The CESSAR should describe the timing of the diesel generator loading and the re-start of the CCWS in regards to the heat load in the reactor coolant system. The current discussion is inadequate to evaluate the CCWS design against the criteria in SRP Paragraph III.3.g.

h. The location of the radiation monitors would prevent their use during periods when the non-essential portions of the CCWS is isolated from the rest of the system (e.g., during accidents or off-normal events). Therefore, the adequacy of this design requires further justification or the monitors should be relocated.

i. While SRP paragraph III.4.c requires conductivity monitors to be installed, the CESSAR does not indicate that monitors are to be provided. The CESSAR should provide additional justification if these monitors are not to be provided.

Response 410.111

a. Two valves in series are provided at each safety/non-safety interface per the response to RAI 410.111 (b). These valves automatically close on a low-low surge tank level. This prevents loss of the safety portion of the system and also limits the water that would be released into the building. The Component Cooling Water System consists of two physically separate divisions. Either division of the system is capable of supporting 100% of the cooling functions necessary for safe reactor shutdown. Due to the physical barriers provided between the two divisions, a flood in one division cannot affect the other division. Using the provisions set forth by Branch Technical Position SPLB 3-1,"Protection Against Postulated Fluid Systems Outside Containment", where the postulated piping failure is assumed to occur in one of two or more redundant trains of a dual-purpose moderate energy essential system , i.e., one required to operate during normal plant conditions as well as to shutdown the reactor and mitigate the consequences of the postulated piping failure, single active failures of components in the other train of that system or other systems necessary to mitigate the consequences of the piping failure and shut down the reactor, need not be assumed provided that the systems are designed to Seismic Category I standards, are powered from both onsite and offsite sources, and are constructed, operated, and inspected to quality assurance, testing, and inservice inspection standards appropriate for nuclear safety systems. Therefore, if one division floods, the other division will be capable of supporting a safe reactor shutdown. (Note: Refer to the response to RAI 410.98 for flood protection.)

b. In accordance with the criteria of ANSI/ANS-51.1-1983, Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, dual isolation valves in series shall be provided at the interfaces between the essential and non-essential portions of the system. Both the supply and return piping interfaces will have dual isolation capabilities. Butterfly valves CC-122 and CC-123 were added to division 1 for non-essential supply and return header isolation respectively. Butterfly valves CC-222 and CC-223 were added to division 2 for non-essential supply and return header isolation respectively.

These valves will receive power from redundant channels within each division. The following channel assignments will be provided:

1. Non-essential supply and return header isolation valves CC-102 and CC-103 will receive power from Channel A.

2. Non-essential supply and return header isolation valves CC-122 and CC-123 will receive power from Channel C.

3. Non-essential supply and return header isolation valves CC-202 and CC-203 will receive power from Channel B.

4. Non-essential supply and return header isolation valves CC-222 and CC-223 will receive power from Channel D.

This response is being incorporated into CESSAR-DC Section 9.2.2,"Component Cooling Water System." The response is reflected as an addition of these isolation valves on Sheet 1 and Sheet 11 of Figure 9.2.2-1,Component Cooling Water System Flow Diagram. The addition of these isolation valves is also reflected by their inclusion in the following parts of CESSAR-DC:

1. Section 9.2.2.2.1.9 - Active Valves
2. Section 9.2.2.5.8 - Safety Injection Actuation Signal (SIAS)
3. Table 9.2.2-5 - Active Valves, Component Cooling Water System

Response 410.111 (continued)

4. Table 9.2.2-6 - Component Cooling Water System Emergency Power Requirements
5. Section 9.2.2.2.2.6 - Loss of Offsite Power

Markups of the aforementioned figures, sections, and tables are attached.

c. Part 1 - Valves CC-1507 and CC-2507 are provided as a method of overpressure protection to prevent damage when the piping is isolated. This practice is consistent with the criteria of Section 3.9 of ANSI/ANS-56.2-1984, Containment Isolation Provisions for Fluid Systems After A LOCA.

Part 2 - The valve and the line which is connected to the valve have no nuclear safety functions. The line connects the non-safety related Component Cooling Water Sump Pumps to the surge tank and provides a pathway for pumping component cooling water to the surge tank when the sump water level is high. The connection between this line and the Class 3 surge tank shall be at a point higher than the normal surge tank water level. Therefore, a failure of this line due to a seismic event should not jeopardize surge tank inventory.

This response is being incorporated into CESSAR-DC Section 9.2.2,"Component Cooling Water System." The line is being moved to a higher point on the surge tanks on Sheet 1 and Sheet 11 of Figure 9.2.2-1 to better reflect its relative position. Also, this response is reflected as a note addition on Sheet 1 and Sheet 11 of Figure 9.2.2-1. Markups of Sheet 1 and Sheet 11 of Figure 9.2.2-1 are attached for NRC review.

Part 3 - The connection between this line and the Class 3 surge tank shall be at a point higher than the normal surge tank water level. Therefore, a failure of this line due to a seismic event should not jeopardize surge tank inventory.

This response is being incorporated into CESSAR-DC Section 9.2.2, "Component Cooling Water System." This response is reflected as a note addition on Sheet 1 and Sheet 11 of Figure 9.2.2-1. Markups of Sheet 1 and Sheet 11 of Figure 9.2.2-1 are attached for NRC review.

d. A break in the Component Cooling Water System piping is detected by the safety related surge tank level instrumentation. A low-low level signal causes the dual isolation valves of the non-essential supply/return headers to automatically close. These features enable the Component Cooling Water System to isolate pipe leaks in the non-essential portions of the system before the surge tank empties and thus provide a continuous source of water to the essential portions of the system. An analysis of the time to manually isolate the non-essential piping and/or time to install the removable spool piece is not required since redundant isolation valves have been provided to meet the single failure criterion. In addition, the redundant division of the CCWS is available for safe shutdown.

e. The design volume of the surge tanks will be calculated upon the completion of detailed pipe routing, since that volume depends on the total system pipe volume to ensure that the surge tank is adequately sized to handle the total system expansion. As stated in CESSAR-DC Section 9.2.2.1.2 Part (D), the Component Cooling Water System is designed to accommodate a thermal expansion from 65°F to 150°F. (Also, in the sizing calculation consideration must be given to the volume of water required to maintain system integrity in the event of a pipe break in the non-essential header.

f. The Demineralized Water Makeup System (DWMS) makeup to the Component Cooling Water Surge tanks is reflected on Sheet 17 and Sheet 18 of Figure 9.2.2-1. The line for DWMS makeup to the CCWS is being moved to Sheet 1 and Sheet 11 of Figure 9.2.2-1 to better reflect normal makeup to the surge tanks.

This response is being incorporated into CESSAR-DC Section 9.2.2, "Component Cooling Water System." The response is reflected as the removal of the DWMS connection from Sheet 17 and Sheet 18 and the addition of the DWMS connection on Sheet 1 and Sheet 11, respectively. Markups of Sheet 1, Sheet 11, Sheet 17, and Sheet 18 are provided for NRC review.

g. For a Design Basis Accident with no concurrent loss of offsite power, the Component Cooling Water Pump in each division will remain operating. However, if Station Loss-of-Offsite Power occurs concurrently with a Design Basis Accident, the Diesel Generator Sequencer will function to load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after the sequencer completes the Accident Loading Sequence. For a Station Loss-of-Offsite Power during which no Design Basis Accident occurs, the sequencer will load the Component Cooling Water Pump which was operating just prior to the event onto the

Response 410.111 (continued)

Emergency Bus within 10 seconds after receiving a Diesel Generator running signal. If this pump fails to operate, the sequencer will attempt to load the other divisional Component Cooling Water Pump onto the Emergency Bus immediately. The sequencer logic will also autostart the standby Component Cooling Water Pump when the operating Component Cooling Water Pump trips or is load shed. After initial loading by the sequencer, the Component Cooling Water Pump which remains on standby may still be manually activated when appropriate manual load shedding of the Emergency Buses is accomplished.

The loss of component cooling water to the Reactor Coolant Pumps is discussed in CESSAR-DC Section 5.4.1.3.

This response is being incorporated into CESSAR-DC Section 9.2.2, Component Cooling Water System. The response is reflected as a revision to Section 9.2.2.2.2.6, "Loss Of Offsite Power". The notes for Table 8.3.1-2 and Table 8.3.1-3 were also revised to reflect the diesel generator loading in regards to the Component Cooling Water System

h. The Component Cooling Water Radiation Monitors are being relocated such that their use will be permitted during periods when the non-essential portions of the CCWS are isolated.

   This response is being incorporated into CESSAR-DC Section 9.2.2, "Component Cooling Water System." The radiation monitors are being relocated to allow their use during all modes of system operation (See Sheet 1 and Sheet 11 of Figure 9.2.2-1). Section 9.2.2.2.1.7, "Component Cooling Water Radiation Monitors," and Section 9.2.2.5.5, "Radiation Monitors," are also being revised to reflect this change. Markups of Figure 9.2.2-1 (Sheet 1 and Sheet 11) and Sections 9.2.2.2.1.7 and 9.2.2.5.5 are provided for NRC review.

i. SRP paragraph III.4.c requires that design provisions are made to ensure the capability to detect leakage of radioactivity or chemical contamination from one system to another. CESSAR-DC Section 9.2.2.3, Safety Evaluations, part (E) states that leakage into or out of the CCWS is detected by the surge tank high, low, and low-low level alarms in the control room. The surge tanks serve as the first indication of leakage into and out of the system. Section 9.2.2.3 also states that radiation monitors are provided to detect the leakage of radioactive fluids into the CCWS. In addition, grab samples shall be utilized as a means of detecting leakage

Response 410.111 (continued)

into the CCWS. Samples taken on a regular basis may indicate changes in chemistry as a result of leakage. Measurements of pH and conductivity can be taken from these grab samples. The surge tank level indicators, the radiation monitors, and the grab samples provide adequate means of detecting leakage. Also conductivity monitors are for the detection of SSWS leakage. The third paragraph of Section 9.2.2.2 states that the CCWS operates at a higher pressure than the SSWS. This prevents the leakage of station service water in the event of a Component Cooling Water Heat Exchanger tube leak. Therefore, the deletion of conductivity monitors is justified.

This response is being incorporated into CESSAR-DC Section 9.2.2,"Component Cooling Water System." This response is reflected as a revision to Section 9.2.2.3, "Safety Evaluations" part (E).

Vents are installed in all high points, and drains are installed in all low points in the component cooling water system.

Vents are located to ensure that the piping is filled with water so as to reduce the chances of water hammer after pump startups. Also, valve opening/closing times are selected to minimize water hammer effects and to ensure isolation of a leak before the component cooling water surge tank empties.

9.2.2.2.1.5 Component Cooling Water Sump Pumps

There are four component cooling water sump pumps: two for Component Cooling Water Sump 1, and two for Component Cooling Water Sump 2. These pumps return the drain water and relief valve discharge to their respective component cooling water surge tank. If the component cooling water should become radioactively contaminated, the sump water is pumped to the Liquid Radioactive Waste Processing System (LRWPS).

9.2.2.2.1.6 Component Cooling Water Chemical Addition Tank

The component cooling water chemical addition tanks provide the capability of adding corrosion-inhibiting chemicals to the system. I

9.2.2.2.1.7 Component Cooling Water Radiation Monitors

A component cooling water radiation monitor, one per division, is provided at the outlet of the component cooling water ~~heat exchangers~~ pumps to detect any CCWS inleakage that contains radioactivity.

9.2.2.2.1.8 Component Cooling Water Heat Exchanger Structure Sump Pumps

Two component cooling water heat exchanger structure sump pumps, one per division, are provided. Each division has a separate sump. The component cooling water heat exchanger structure sump collects the component cooling water drained from the CCW heat exchangers. The sump pumps return the sump water to their respective heat exchangers. Alternate paths can direct the sump water to the component cooling water sump located in the Nuclear Annex or to the Liquid Radioactive Waste Processing System.

9.2.2.2.1.9 Active Valves

The valves required to maintain their functional capability during a safe plant shutdown are listed in Table 9.2.2-5 and described in the following sections.

A. Non-Essential Supply Header Isolation Valves

Valves CC-102 and CC-202 are pneumatically controlled valves that fail closed on loss of instrument air. These valves close to terminate component cooling water flow to the non-essential equipment in the event of an accident. These valves automatically close on SIAS or low component cooling water surge tank level. The valve closure times are adequate to prevent complete loss of surge tank volume due to a break in the non-safety piping.

B. Non-Essential Return Header Isolation Valves

Valves CC-103 and CC-203 isolate the non-essential return headers from the essential return headers in the event of an accident. These valves are pneumatically controlled and fail closed on loss of instrument air. They automatically close on SIAS or low component cooling water surge tank level. The valve closure times are adequate to prevent complete loss of surge tank volume due to a break in the non-safety piping. I

C. Shutdown Cooling Heat Exchangers 1 and 2 Control Valves

Valves CC-110 and CC-210 provide a constant flow of 11,000 gpm to their respective heat exchangers. The valves are pneumatically controlled and fail open on loss of instrument air. These valves are provided with travel stops to restrict maximum flow.

D. Shutdown Cooling Heat Exchangers 1 and 2 Isolation Valves

Valves CC-111 and CC-211 provide component cooling water flow isolation for the shutdown cooling heat exchangers. These valves are provided with electric motor operators and can be manually opened and closed from the control room.

E. Spent Fuel Pool Cooling Heat Exchangers 1 and 2 Isolation Valves

Valves CC-113 and CC-213 close to terminate component cooling water flow to the spent fuel pool heat exchangers in the event of an accident. These valves are provided with electric motor operators and automatically close on SIAS. A manual override is provided in the control room so that flow can be reestablished, heat load permitting, to the heat exchangers during a design basis accident.

The control valves, CC-114 and CC-214, located downstream of the containment spray heat exchangers automatically open on CSAS or high component cooling water pump differential pressure. These valves can also be manually opened and closed from the control room.

The following containment isolation valves close upon receipt of a Containment Isolation Actuation Signal (CIAS):

RCP Drain Header Division 1: CC-150, CC-151.

RCP Drain Header Division 2: CC-250, CC-251.

Supply to the letdown heat exchanger: CC-140, CC-141.

Return from the letdown heat exchanger: CC-142, CC-143.

A low pump differential pressure signal is indicative of a failure of the running pump or an increase in cooling water flow requirements. The idle CCW pump will automatically start on this signal. This assures that there will be no flow degradation to the essential and non-essential component cooling water heat sources.

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9.2.2.2.2.6 **Loss of Offsite Power**

A loss of offsite power (LOOP) results in the shutdown and restarting of the CCWS in accordance with the diesel generators' load sequencing. ADD INSERT A

During a LOOP, the instrument air compressors are powered from the alternative A/C (AAC) power source. The AAC power source for this design is a non-safety grade combustion gas turbines. If the non-safety grade instrument air system is lost, all pneumatic control valves would fail to their failed positions. The following safety related valves will fail closed on loss of the instrument air system:

A. Non-essential supply header isolation valves: CC-102, CC-122, ~~and~~ CC-202, and CC-222.

B. Non-essential return header isolation valves: CC-103, CC-123, ~~and~~ CC-203, and CC-223.

C. Component cooling water heat exchanger bypass control valves: CC-100, CC-101, CC-200, and CC-201.

The following safety related valves will fail open on a loss of the instrument air system:

CESSAR-DC Attachment (Refer to page 9.2-34)

INSERT A:

For a Design Basis Accident with no concurrent loss of offsite power, the Component Cooling Water Pump in each division will remain operating. However, if Station Loss-of-Offsite Power occurs concurrently with a Design Basis Accident, the Diesel Generator Sequencer will function to load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after the sequencer completes the Accident Loading Sequence. For a Station Loss-of-Offsite Power during which no Design Basis Accident occurs, the sequencer will load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after receiving a Diesel Generator running signal. If this pump fails to operate, the sequencer will attempt to load the other divisional Component Cooling Water Pump onto the Emergency Bus immediately. The sequencer logic will also autostart the standby Component Cooling Water Pump when the operating Component Cooling Water Pump trips or is load shed. After initial loading by the sequencer, the Component Cooling Water Pump which remains on standby may still be manually activated when appropriate manual load shedding of the Emergency Buses is accomplished.

A. Shutdown cooling heat exchanger control valves: CC-110 and CC-210.

B. Spent fuel pool cooling control valves: CC-112 and CC-212.

The fail positions of the pneumatic valves assure safety of the plant.

9.2.2.3 Safety Evaluations I

Safety evaluations are numbered to conform to the safety design bases and are as follows:

A. The CCWS has the capability to dissipate the imposed heat loads within the safe reactor shutdown time frame.

Loss of offsite power results in the shutdown and restarting of the CCWS in accordance with the diesel generators' load sequencing. The diesel generators' load capacity and sequencing times fulfill CCWS requirements. Thus, safe reactor shutdown is supported by the CCWS. E

B. The CCWS flow and heat transfer capabilities are compatible with providing the required component cooling water within the limits of 65°F and 120°F during a design basis accident.

C. The CCWS is composed of two physically separate, independent, full-capacity divisions each of which is powered from separate Class 1E Auxiliary Power Systems and separate diesel generators. This ensures that a single failure does not impair the system's effectiveness. Refer to Table 9.2.2-2 for the single failure analysis. I

D. Components of the CCWS are installed in buildings that protect against adverse environmental conditions. E

E. Leakage into or out of the CCWS is detected by the surge tank high, low, and low-low level alarms in the control room. Radiation monitors indicate leakage of radioactive fluids into the CCWS. Also, grab samples are utilized as a means of detecting leakage into the CCWS. I

F. This statement is self explanatory.

G. The essential portions of the CCWS are Seismic Category I.

H. Components of the CCWS are capable of being fully tested during normal operation since one pump from each division is operating at full flow conditions. ASME Code Section XI, in service pump tests may be satisfactory performed without violation of Technical Specifications.

D. Component Cooling Chemical Addition Tanks Level

Local level indications are provided for the component cooling chemical addition tanks.

9.2.2.5.5 Radiation Monitors

Radiation monitors are provided downstream of the component cooling ~~heat exchangers~~ water pumps. An alarm is sounded in the control room if radiation is detected at a preset level above background by one of the monitors.

9.2.2.5.6 Interlocks

The component cooling water sump pumps are automatically started when the sump level rises to a predetermined value. At this level in sump 1, valve CC-153 opens; and at this level in sump 2, valve CC-253 opens. The sump pumps pump component cooling sump water to their respective surge tank and are automatically stopped at a preset surge tank level or a sump low level. Valves CC-153 and CC-253 close when their respective sump pumps are automatically stopped. I

Demineralized water is automatically supplied to the surge tanks when the tank level drops to a predetermined value. Upon reaching this level in surge tank 1, valves CC-152 and CC-153 open; and upon reaching this level in surge tank 2, valves CC-252 and CC-253 open. These valves close when the tank level reaches a predetermined value. Manual overrides are provided for the sump pumps and valves CC-152, CC-153, CC-252 and CC-253.

Upon loss of component cooling water to the letdown heat exchanger, letdown flow is terminated.

9.2.2.5.7 Time Delays

The start of the second component cooling water pump is delayed by 10 seconds when a low differential pressure signal is actuated on the operating pump.

9.2.2.5.8 Safety Injection Actuation Signal (SIAS)

The following valves close on SIAS:

1. Non-essential supply heade isolation valves: CC-102, CC-122, ~~and~~ CC-202, and CC-222.
2. Non-essential return header isolation valves: CC-103, CC-123 ~~and~~ CC-203, and CC-223.

TABLE 9.2.2-5

(Sheet 1 of 3)

ACTIVE VALVES, COMPONENT COOLING WATER SYSTEM

Valve Number	Safety Function	Valve Type	ASME Section III Code Class	Actuator Type
CC-100	Close	Throttle	3	Pneumatic
CC-101	Close	Throttle	3	Pneumatic
CC-102	Close	Butterfly	3	Pneumatic
CC-103	Close	Butterfly	3	Pneumatic
CC-106	Operate	Butterfly	3	Electric Motor
CC-107	Operate	Butterfly	3	Electric Motor
CC-108	Operate	Butterfly	3	Electric Motor
CC-109	Operate	Butterfly	3	Electric Motor
CC-110	Open	Throttle	3	Pneumatic
CC-111	Operate	Butterfly	3	Electric Motor
CC-112	Open	Throttle	3	Pneumatic
CC-113	Close	Butterfly	3	Electric Motor
CC-114	Open	Butterfly	3	Electric Motor
CC-122	Close	Butterfly	3	Pneumatic
CC-130	Close	Butterfly	2	Electric Motor
CC-1302	Operate	Swing Check	3	None
CC-1303	Operate	Swing Check	3	None
CC-131	Close	Butterfly	2	Electric Motor
CC-136	Close	Butterfly	2	Electric Motor
CC-137	Close	Butterfly	2	Electric Motor
CC-140	Close	Butterfly	2	Electric Motor
CC-123	Close	Butterfly	3	Pneumatic

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TABLE 9.2.2-5 (Cont'd)

(Sheet 3 of 3)

ACTIVE VALVES, COMPONENT COOLING WATER SYSTEM

Valve Number	Safety Function	Valve Type	ASME Section III Code Class	Actuator Type
CC-210	Open	Throttle	3	Pneumatic
CC-211	Operate	Butterfly	3	Electric Motor
CC-212	Open	Throttle	3	Pneumatic
CC-213	Close	Butterfly	3	Electric Motor
CC-214	Open	Butterfly	3	Electric Motor
CC-222	Close	Butterfly	3	Pneumatic
CC-230	Close	Butterfly	2	Electric Motor
CC-2302	Operate	Swing Check	3	None
CC-2303	Operate	Swing Check	3	None
CC-231	Close	Butterfly	2	Electric Motor
CC-236	Close	Butterfly	2	Electric Motor
CC-237	Close	Butterfly	2	Electric Motor
CC-250	Close	Gate	2	Electric Motor
CC-2507	Operate	Swing Check	2	None
CC-251	Close	Gate	2	Electric Motor
CC-2548	Operate	Swing Check	2	None
CC-2717	Operate	Swing Check	2	None
CC-223	Close	Butterfly	3	Pneumatic

I

Non-essential Header 1 Supply and Return Isolation Valves CC-122 and CC-123, Open/Close   C

TABLE 9.2.2-6 (Cont'd)

(Sheet 2 of 3)

COMPONENT COOLING WATER SYSTEM
EMERGENCY POWER REQUIREMENTS

Component Cooling Water System Motor-Operated Valves (Cont'd)

Valve	Emergency Channel
CC-142	B
CC-143	A
CC-111	A
CC-113	C
CC-114	C
CC-211	B
CC-213	D
CC-214	D
CC-150	A
CC-151	B
CC-250	A
CC-251	B

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Component Cooling Water System Controls

Controls	Emergency Channel
Component Cooling Water Pump 1A Start/Stop	A
Component Cooling Water Pump 1B Start/Stop	C
Component Cooling Water Pump 2A Start/Stop	B
Component Cooling Water Pump 2B Start/Stop	D
Non-essential Header 1 Supply and Return Isolation Valves CC-102 and CC-103, Open/Close	A
Non-essential Header 2 Supply and Return Isolation Valves CC-202 and CC-203, Open/Close	B
Non-essential Header 2 Supply and Return Isolation Valves CC-222 and	D

Table 8.3.1-2 (Cont'd)

(Sheet 19 of 21)

DIVISION I CLASS 1E LOADS AND DIESEL GENERATOR LOAD SEQUENCER
NOTES, ASSUMPTIONS AND INFORMATION REQUIRED FOR ANALYSIS

NOTE I

For a Design Basis Accident with no concurrent loss of offsite power, the Component Cooling Water Pump in each division will remain operating. However, if Station Loss-of-Offsite-Power occurs concurrently with a Design Basis Accident, the Diesel Generator Sequencer will function to load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after the sequencer completes the Accident Loading Sequence. For a Station Loss-of-Offsite-Power during which no DBA occurs, the sequencer will load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after receiving a Diesel Generator running signal. If this pump fails to operate, the sequencer will attempt to load the other divisional Component Cooling Water Pump onto the Emergency bus immediately. The sequencer logic will also autostart the standby Component Cooling Water Pump when the operating Component Cooling Water Pump trips or is load shed.

After initial loading by the sequencer, the Component Cooling Water Pump which remains on standby may still be manually activated ~~, or automatically activated by the sequencer should Low Component Cooling Water Pump pressure be detected. There will be a 10 second time delay between the system acknowledging running Component Cooling Water Pump Low Differential Pressure and the actual permissive to start the standby Component Cooling Water Pump. The sequence will also be interlocked so as to prohibit loading of the second divisional Component Cooling Water Pump until 5 seconds have elapsed following loading of the Essential Chiller.~~ when appropriate manual load shedding of the Emergency Buses is accomplished. I

1. The sequencer will attempt to load onto the Emergency Bus the Station Service Water Pump which was operating just prior to a Station Loss-of-Offsite-Power. This also applies to Design Basis Accident coincident with a Station Loss-of-Offsite-Power. The SSW Pump not loaded by the sequencer will remain on standby, capable only of being started manually when Operations determines that the corresponding increase in the Diesel Generator loading is warranted (2 pumps/division operation) or when pump cycling is desired. Sequencer logic will prohibit automatic loading of both a division's SSW Pumps.

2. If a LOCA occurs and offsite power remains uninterrupted, the running SSW pump will remain operational, still connected to normal incoming bus.

3. If the SSW Pump chosen to start by the sequencer fails to start, the sequencer will attempt to start the other SSW pump immediately.

4. The Sequencer will load the SSW Pump 10 seconds after either the completion of all Accident loadings or the sequencer's receipt of a Diesel Generator running signal (Normal Loss-of-Offsite-Power sequence).

Attachment ABWR-346 NRC RAI 410.111

Table 8.3.1-3 (Cont'd)

(Sheet 19 of 21)

DIVISION II CLASS 1E LOADS AND DIESEL GENERATOR LOAD SEQUENCER
NOTES, ASSUMPTIONS AND INFORMATION REQUIRED FOR ANALYSIS

NOTE I

For a Design Basis Accident with no concurrent loss of offsite power, the Component Cooling Water Pump in each division will remain operating. However, if Station Loss-of-Offsite-Power occurs concurrently with a Design Basis Accident, the Diesel Generator Sequencer will function to load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after the sequencer completes the Accident Loading Sequence. For a Station Loss-of-Offsite-Power during which no DBA occurs, the sequencer will load the Component Cooling Water Pump which was operating just prior to the event onto the Emergency Bus within 10 seconds after receiving a Diesel Generator running signal. If this pump fails to operate, the sequencer will attempt to load the other divisional Component Cooling Water Pump onto the Emergency bus immediately. The sequencer logic will also autostart the standby Component Cooling Water Pump when the operating Component Cooling Water Pump trips or is load shed.
After initial loading by the sequencer, the Component Cooling Water Pump which remains on standby may still be manually activated~~, or automatically activated by the sequencer should Low Component Cooling Water Pump pressure be detected. There will be a 10 second time delay between the system acknowledging running Component Cooling Water Pump Low Differential Pressure and the actual permissive to start the standby Component Cooling Water Pump. The sequencer will also be interlocked so as to prohibit loading of the second divisional Component Cooling Water Pump until 5 seconds have elapsed following loading of the Essential Chiller~~ when appropriate manual load shedding of the Emergency Buses is accomplished.

1. The sequencer will attempt to load onto the Emergency Bus the Station Service Water Pump which was operating just prior to a Station Loss-of-Offsite-Power. This also applies to Design Basis Accident coincident with a Station Loss-of-Offsite-Power. The SSW Pump not loaded by the sequencer will remain on standby, capable only of being started manually when Operations determines that the corresponding increase in the Diesel Generator loading is warranted (2 pumps/division operation) or when pump cycling is desired. Sequencer logic will prohibit automatic loading of both a division's SSW Pumps.

2. If a LOCA occurs and offsite power remains uninterrupted, the running SSW pump will remain operational, still connected to normal incoming bus.

3. If the SSW Pump chosen to start by the sequencer fails to start, the sequencer will attempt to start the other SSW pump immediately.

4. The Sequencer will load the SSW Pump 10 seconds after either the completion of all Accident loadings or the sequencer's receipt of a Diesel Generator running signal (Normal Loss-of-Offsite-Power sequence).

I

Question 410.112

Condensate Storage System (CSS)

a. A P&ID should be provided to support the review of this system, in regards to system isolation from safety-related systems (e.g., Emergency Feedwater System) since this system provides no safety-related function.

   - The isolation provisions of this system should be discussed in the CESSAR.

b. Would the rupture of the non-seismic Condensate Storage Tank(s) result in flooding? Would this affect safety-related equipment or result in contamination of surrounding area?

Response 410.112

a. A flow diagram of the Condensate Storage System will be added to CESSAR-DC Section 9.2.6 as Figure 9.2.6-1 in a future amendment (see attached). The Emergency Feedwater System (EFW) is the only safety-related system with a direct connection to the CSS. Provisions for isolation of the CSS from EFW are found in the EFW system itself. CESSAR-DC Figure 10.4.9-1 (P&ID for EFW system) shows connections from the condensate makeup (condensate storage tank) to the EFW storage tanks. Normal position for valves in these connections is closed.

b. Section 9.2.6.2 of CESSAR-DC states that Condensate Storage "system leakage or storage tank failure will not result in unacceptable environmental effects." This statement applies not only to flooding but also to release of radioactive liquid. Contamination of water in the condensate storage system would be possible only as a result of a primary-to-secondary side steam generator tube leak, via the drain lines from the condenser hotwell to the condensate drain tank.

   The condensate storage tank, located in the Yard, is designed to meet the requirements of NRC Regulatory Guide 1.143, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants. Specifically, the condensate storage tank has the following design features:

   - Liquid-level monitors, with local and control room high-liquid-level alarms
   - Tank overflow, drain, and sample lines routed to Turbine Building Sump System

Response 410.112

* A seismically-designed dike or retention pond of sufficient height/size capable of preventing runoff in the event of tank overflow/rupture

These design features ensure prevention of both release of radioactive liquids and flooding of areas surrounding the condensate storage tank.

CESSAR-DC Section 9.2.6.2 will be updated to more clearly define the condensate storage tank design features.

RAI 410.112

J. Other Miscellaneous Condensate Quality Drains E

The following functional requirements are met to provide a reliable system:

A. The minimum capacity of the condensate storage tanks is based on the maximum condensate usage during startup (e.g., maximum steam generator blowdown level x startup duration) plus a 100% margin. B

B. A minimum of two condensate storage tanks are provided.

C. Two pumps are provided for recycling back to the degasifier located in the demineralized water makeup system.

D. The condensate storage system tanks are to be constructed of stainless steel.

E. Stainless steel floating covers are recommended to minimize air ingress.

F. A failure of a Condensate Storage System component connected to a safety-related system does not affect the safe shutdown or accident mitigation function of the safety-related system.

G. System leakage or storage tank failure will not result in unacceptable environmental effects. Insert from next page E

H. Condensate Storage Tanks are provided with overflow lines which are large enough to handle any storage tank overflow and route that overflow to the Turbine Building sump.

9.2.6.3 Safety Evaluation

The Condensate Storage System is not safety-related because the assured source of water for the emergency feedwater system is provided by the Emergency Feedwater Storage Tanks. The safety analysis is, therefore, not affected by the design of the Condensate Storage System. B

9.2.6.4 Inspection and Testing Requirements

Prior to startup, all piping is flushed and hydrostatically tested in accordance with applicable codes and standards. System operability is verified by placing the system into operation prior to fuel loading. After startup, routine visual inspection of the system components and instrumentation is adequate to verify system operability. I B

Attachment to CESSAR-DC Change Package for Section 9.2.6

Append the following to section 9.2.6.2, functional requirements item G. (location as indicated on page 9.2-61):

The Condensate Storage Tank, located in the Yard, is also designed to meet with the requirements of NRC Regulatory Guide 1.143, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants. Specifically, the Condensate Storage Tank has the following design features:

- Liquid-level monitors, with local and control room high-liquid-level alarms.
- Radiation monitors, with local and control room alarms.
- Tank overflow, drain, and sample lines routed to Turbine Building sump.
- A seismically-designed dike or retention pond of sufficient height/size capable of preventing runoff in the event of tank overflow/rupture (site characteristic dependent).

Question 410.113
(9.2.9)

a. A P&ID should be provided for the Chilled Water Systems (CWS) to allow for a review of system isolation between the essential and normal portions of the CWS. The sketch provided is inadequate to support a review of the design adequacy of the system.

b. The Safety Analysis should indicate that the Essential Chilled Water System would be protected from pipe breaks, pipe whip, tornado missile damage, jet impingement or severe environmental conditions. Please provide this information.

Response 410.113
(9.2.9)

a. Flow Diagrams are attached for the Essential and Normal Chilled Water Systems.

b. The Essential Chilled Water System shall be protected from the pipe breaks, pipe whip, tornado missile damage, jet impingement or severe environmental conditions.

A mark-up of CESSAR-DC Section 9.2.2.3 is attached and will be incorporated in a future amendment.

B. Other Buildings using NCWS: E

1. The NCWS consists of two 100% capacity circuits each comprising two chilled water pumps, two 50% chillers, one air separator, one compression tank, and associated air handling units. I

2. The system is designed to provide an adequate quantity of chilled water to the air-handling units at a maximum of 42°F leaving water temperature from the chiller, and a maximum of 10°F ΔT across the chiller. E I

3. Each pump suction is connected to a common return header while each chiller discharge is connected to a common supply header.

4. The condenser of each water chiller is cooled by the plant CCWS system during all normal operating conditions. E

5. Each chiller/pump combination is cross connected in order that each pump can serve each chiller in a given room. I

6. The system incorporates features that assure its reliable operation over a full range of normal plant operation. These features include the installation of redundant principal system components.

9.2.9.3 <u>Safety Evaluation</u>

9.2.9.3.1 ECWS E

The ECWS is designed to provide chilled water at the required temperature and flow rate.

The ECWS is divided into two trains, each supplied with redundant power sources and redundant essential cooling water system trains. No single failure can impair the ability of the system to function.

The ECWS is designed to Seismic Category I criteria.

The ECWS is provided with sufficient access and removable insulation to permit visual inspection of the piping and equipment surfaces.

The ECWS is protected from missiles by means of physical separation of redundant units and by use of adequate building structure where it is located.

Add Insert 1

Insert 1

The Essential Chilled Water System shall be protected from pipe breaks, pipe whip, tornado missile damage, jet impingement or severe environmental conditions.

Question 410.114

a. Part (a) to the response to Question 410.81 referenced CESSAR Figure 9.3.1-1 which had been incorporated in Amendment I. Please respond to the following on this figure.

   1. Confirm that the outboard motor-operated containment isolation valve and the associated inboard check valve represent the only safety-related portion of the Compressed Gas System.

   2. The figure reflects three (3) instrument air compressors while Section 9.3.1.2.1 states that "Instrument air is supplied by two, 100% capacity instrument air compressors."

   3. This figure does not indicate whether valve operators are manual, motor or air operated. This information is needed to determine the isolation capability provided by the design.

b. Part (b) to the response to Question 410.81 indicated that Table 9.3.1-1, "Active Safety-Related Components Serviced by Instrument Air", had been included in Amendment I. This table was not provided with Appendix I and revisions to Section 9.3.1 do not include any reference to this table.

c. Part (c) to the response to Question 410.81 stated: "To assure separation of the air systems, the systems have no interconnections." However, Section 9.3.1.2.2 of the CESSAR (Amendment I) indicates: "In the event of low instrument air pressure, the Station Air System will automatically supply air to the Instrument Air System. This air will be supplied through two oil removal filters to the instrument air compressors discharge header".

   The text in Section 9.3.1.2.1 is inconsistent with the response to Question 410.81, Part (c) cited above. In addition, the connection between the IA System and the Service Air System could not be identified on Figure 9.3.1-1.

d. The CESSAR should be revised to address the following questions on the design of the Compressed Air System.

   1. Confirm that the Instrument Air System is not safety-related and not seismically qualified [except as noted in Item (1) of Question (a) above.]

   2. Is the Instrument Air System to operate with one compressor operating at a time? If so, is there a

setpoint which would actuate the other (or one of the other two) compressors? If one IA compressor is operated at a time, would the failure of this operating compressor result in the movement of all safety-related (and non-safety related) air operated valves to their fail-safe condition? Would this increase the probability of shutdowns during normal operation?

3. Provide P&IDs for the Station Air System and Breathing Air System.

4. Figure 9.3.1-1 indicates that, except for a single check valve, there is no separation between the portion of the IA System that supplies safety-related components and systems and the portion that supplies non-safety related components and systems. Could this result in an increased potential for the failure of non-safety related valves to adversely affect the operability of safety-related valves (and, therein, cause more shutdowns)?

5. Section 9.3.1.1 indicates that the IA System will provide oil free air to safety-related components. However, the text does not identify whether this will be achieved via filtration or the use of 'dry' compressors. This issue should be clarified.

6. Information provided in Part (d) of the response to Question 410.81 should be incorporated into the CESSAR for completeness.

e. The Standard Review Plan requires the air quality to comply with quality standards specified in ANSI MC 11.1-1976 (ISA S7.3). The ANSI standard requires a dew point for indoor installations to be at least 10°C below the minimum temperature expected. In addition, it specifies that: "In no case, should the dew point at line pressure exceed 2°C (approximately 35°F)." Contrary to this requirement, Section 9.3.1.2.1 indicated that the Instrument Air System is to be dried to a dew point of 30°F to 39°F by refrigerated air dryers. The current design does not, therefore, comply with the ANSI standard and should be justified.

f. Provide a list of instrumentation supplied by the Instrument Air System. Identify which of these instruments are essential to safe shutdown or accident mitigation, and evaluate the effects of loss of

Question 410.114 (Cont'd)

instrument air on these instruments. (This question was previously submitted as Question 410.51.)

Response 410.114

a. 1. The Compressed Air Systems (Instrument Air, Station Air, and Breathing Air) are non-safety related with the exception of the containment isolation valves and associated piping which are Safety Class 2. The Safety Class designations of the Compressed Air Systems are reflected in the system P&IDs (CESSAR-DC Figures 9.3.1-1, 9.3.1-2, and 9.3.1-3) and CESSAR-DC Section 9.3.1.3 will be revised to indicate the safety-related portions of the Compressed Air Systems.

2. The Instrument Air System consists of four instrument air compressors. CESSAR-DC Figure 9.3.1-1 and Section 9.3.1.2.1 will be revised to reflect four instrument air compressors.

3. The valve types and operators of the containment isolation valves are shown in Figure 9.3.1-1. This figure accurately reflects the isolation capability of the safety-related portion of the Instrument Air System. All other valves are non-safety related, and as such, specification of particular types of operators is not necessary to make a safety determination.

b. CESSAR-DC Table 9.3.1-1 "Active Safety-Related Components Serviced by Instrument Air" will be included in CESSAR-DC and Section 9.3.1.3 will be revised to reference this table (attached). The attached revisions superseed those presented in the response to RAI 440.60 (C-E letter LD-91-024, May 16, 1991).

c. There are no interconnections between any of the Compressed Air Systems of System 80+™. CESSAR-DC Section 9.3.1.2.1 will be revised.

d. 1. CESSAR-DC Section 9.3.1 will be revised to confirm the Instrument Air System is non-safety related with the exception of the containment isolation valves which are Safety Class 2, Seismic Category I. The remaining portions of the system shall be classified as non-seismic with the exception of portions which may interact with safety-related equipment or components. In this case, these portions shall be classified as Seismic Category II.

2. The Instrument Air System normally operates with one of the four 100% compressors operating at a time. The remaining compressors serve as standbys and start automatically if the operating compressor cannot meet system demand. Controls are provided such that the failure of the operating compressor does not result in the line pressure decreasing below the minimum pressure required for component operation. In addition, adequate reserve capacity is provided in the air receivers to allow time for standby compressors to start and recharge the air receivers to operating pressure following a compressor trip. Therefore, failure of the operating compressor does not increase the probability of shutdowns during normal operation. CESSAR-DC Section 9.3.1.2.1 will be revised to reflect these design features.

3. P&IDs for the Station Air System and the Breathing Air System will be included in CESSAR-DC as CESSAR-DC Figures 9.3.1-2 and 9.3.1-3 and CESSAR-DC Sections 9.3.1.2.2 and 9.3.1.2.3 will be revised to reference these figures.

4. The Instrument Air System is a non-safety related system and as such, provides a non-safety related supply of compressed air to all air operated instrumentation and valves. Therefore, no separation is required between portions of the distribution piping which supply safety-related components and portions supplying non-safety related components. The check valve shown in CESSAR-DC Figure 9.3.1-1 is not a requirement for separating the supplies of instrument air as no such requirement is necessary for the Instrument Air System. The solenoids on pneumatically operated active safety-related valves are the safety-related means to ensure that these valves fail to the safe position on loss of instrument air and therefore, shall be classified as safety-related components.

5. CESSAR-DC Section 9.3.1.2.1 will be revised to show that the instrument air compressors are of oil free design.

Response 410.114 (Cont'd)

6. The information previously referenced in Part (d) of the response to Question 410.81 will be incorporated in CESSAR-DC Section 9.3.1.3 (attached). The attached revisions superseed those presented previously in response to RAI 440.60 (C-E letter LD-91-024, May 16, 1991).

e. CESSAR-DC Section 9.3.1.2.1 will be revised to indicate the Instrument Air System utilizes regenerative desiccant dryers to dry the compressed air to a dew point of -40°F at line pressure. In addition, a statement will be added to affirm the instrument air system shall be capable of producing compressed air of a quality commensurate with the requirements of ANSI/ISA-S7.3-1975 (R1981).

f. Instrument air is not required for any instrumentation which is needed for accident mitigation or to reach safe shutdown. Therefore, a listing of all instrumentation supplied by the Instrument Air System is not provided in CESSAR-DC and compilation of such a list is not feasible until specific components are identified for procurement.

9.3 PROCESS AUXILIARIES

9.3.1 COMPRESSED AIR SYSTEMS

9.3.1.1 Design Bases

The Compressed Air System consists of the Instrument Air, Station Air, and Breathing Air Systems. The Instrument Air System supplies clean, oil free, dried air to all air operated instrumentation and valves. The Station Air System supplies compressed air for air operated tools, miscellaneous equipment, and various maintenance purposes. The Breathing Air System supplies clean, oil free low pressure air to various locations in the plant, as required for breathing protection against airborne contamination while performing certain maintenance and cleaning operations. I

9.3.1.1.1 Codes and Standards

The compressed air systems and associated components are designed in accordance with applicable codes and standards. The design conforms to General Design Criteria 1, 2 and 5 and meets the intent of the Standard Review plan.

9.3.1.2 System Description

DELETE & ADD INSERT 1

9.3.1.2.1 Instrument Air System

A flow diagram of Instrument Air System is shown in Figure 9.3.1-1. I

Instrument air is supplied by two, 100% capacity instrument air compressors. The compressor intakes are in an area free of corrosive contaminants and hazardous gases. Downstream of each air compressor, the hot compressed air flows through an aftercooler and water separator before discharging into an instrument air receiver. The aftercooler cools the hot compressed air to within 10°F of the Turbine Building Cooling Water System (TBCWS) temperature, and the water separator removing any water condensed in the cooling process. The air receivers smooth out any pressure surges. Downstream of the air receivers, the instrument air is dried to a dew point of 35°F to 39°F by four refrigerated air dryers. In addition, desiccant air dryers are provided on the lines going outside the building to dry the air to a design dew point of -40°F. After the refrigerated air dryers, the air is passed through filters which filter our particles larger than 3 microns. Downstream of the filters, the instrument air headers supply instrument air throughout the plant. At each air operated valve or instrument the air is filtered again through a filter-regulator. I

NRC RAI 410.114

9.3.1.2.1 Instrument Air System (CESSAR-DC Page 9.3-1)

INSERT 1:

A flow diagram of the Instrument Air System is shown in Figure 9.3.1-1.

The Instrument Air System consists of four parallel trains of instrument air compressors and associated equipment. Each train of equipment is capable of supplying the plant's instrument air needs. The Instrument Air System equipment is located in the Nuclear Annex with two instrument air trains located in each division. Each instrument air train consists of an instrument air compressor, an air receiver, and an instrument air dryer connected in series.

Each compressor is of oil-free, water-cooled design and is capable of providing 100% of the instrument air requirements for the generating unit. Cooling water is supplied to the compressors from the Component Cooling Water System (CCWS). The compressors are designed to cool the hot compressed air and remove water condensed in the cooling process. Each compressor is furnished with an intake filter/silencer rated to remove all particles greater than 5 microrns (μm). The compressor intakes are located in an area free of corrosive contaminants and hazardous gases.

During normal plant operating conditions, one of the compressors is selected for continuous operation while the other compressors serve as standbys and start automatically if the continuously operating compressor cannot meet system demand. The compressor controls are designed to allow continuous operation of any number of the compressor motors with the compressors automatically loaded and unloaded in response to system pressure. The controls also permit automatic start and stop operation of any number of the compressor motors in response to system pressure as evidenced by a pressure drop in the instrument air distribution piping. The compressor controls are designed such that failure of an operating compressor will not cause system pressure to decrease below the minimum required system operating pressure. A compressor switching arrangement allows any one of the compressors to be chosen as the base compressor while the others serve as standbys. This capability enables the compressors to have equal wear. Startup of a standby compressor is annunciated in the control room.

Downstream of each air compressor, the compressed air flows into an instrument air receiver. The air receivers dampen pressure fluctuations and serve as a pressure reservoir for sudden demands on the system. The air receivers are designed with adequate reserve capacity to allow time for standby compressors to start and recharge the air receivers to operating pressure following a compressor trip. Control room indicators are provided for individual air receiver temperature and pressure to allow remote

NRC RAI 410.114

9.3.1.2.1 Instrument Air System (CESSAR-DC Page 9.3-1)

INSERT 1: (CONT'D)

monitoring of system operation status for each supply train on an on-demand basis.

Downstream of the air receivers the instrument air passes through an instrument air dryer before being distributed to the instrument air piping system. Each air dryer is equipped with a coalescing prefilter, an air dryer assembly, and an afterfilter connected in series which are capable of drying the compressed air to a dewpoint of -40°F at line pressure and filtering the air of hydrocarbons, water aerosols, and particulates greater than one micron in size.

Downstream of the air dryers, the four instrument air trains are headered together and connecting distribution piping supplies instrument air throughout the plant. The instrument air lines penetrating the containment have an electrically operated isolation valve located outside containment which is installed in series with a check valve located inside the containment.

DELETE

In the event of low instrument air pressure, the Station Air System will automatically supply air to the Instrument Air System. This air will be supplied through two oil removal filters to the instrument air compressors discharge header.

The bulk air supply to the condensate polishing demineralizers will come off the instrument air compressors discharge header upstream of the instrument air dryers. Two check valves with a trap between them will be provided in this supply line to prevent the backflow of water into the Instrument Air System.

9.3.1.2.2 Station Air System

Station air is supplied by two, 100% capacity station air compressors. Downstream of each air compressor, the hot compressed air flows through an aftercooler and water separator before discharging into a station air receiver. The aftercooler cools the hot compressed air to within 10°F of the conventional TBCWS temperature, and the water separator removes any water condensed in the cooling process. The air receivers smooth out any pressure surges. Downstream of the air receivers, the station air headers carry station air throughout the plant.

9.3.1.2.3 Breathing Air System

Breathing air is supplied by two, 100% capacity breathing air compressors. Downstream of each compressor, the compressed air flows through three filters, an aftercooler, and dryer before discharging into a breathing air receiver which serves to smooth out the air flow. The receiver discharge lines join and supply breathing air to various locations in the Auxiliary Building and inside the Containment.

9.3.1.3 <u>Safety Evaluation</u>

DELETE AND ADD INSERT A

The Compressed Air System is designed to provide dependable sources of compressed air for all plant uses. Sufficient redundancy is provided to give a high degree of reliability to the air supply at all times. Sufficient air receiver capacity is provided to meet system high air demand transients.

Failure of the Compressed Air System will not render any safety system equipment or its function inoperable. A loss of instrument air during an accident or plant blackout would cause all pneumatically operated valves in the station which are essential for safe shutdown to fail in the safe position. Therefore, the Compressed Air System is not relied upon for any safe shutdown or accident mitigation function.

ADD INSERT 2

NRC RAI 410.114

CESSAR-DC Attachment (Refer to page 9.3-2)

INSERT A:

9.3.1.2.2 Station Air System

The Station Air System is shown in Figure 9.3.1-2. Station air is supplied by two, oil-free, 100% capacity station air compressors. Each compressor package contains an intercooler, aftercooler, and moisture separators. The compressors use cooling water from the TBCW system to cool the hot compressed air and any water condensed in the cooling process is removed by the compressor moisture separators and automatic drain valves. Downstream of the compressors the air flows to air receivers which serve to smooth out pressure surges. The air is then dried by one of two redundant station air dryers prior to being distributed throughout the plant via station air headers.

9.3.1.2.3 Breathing Air System

The Breathing Air System is shown in Figure 9.3.1-3. Breathing Air is supplied by two, oil-free, 100% capacity breathing air compressors. Each compressor package contains an intercooler, aftercooler, and moisture separators. The compressors use cooling water from the TBCW system to cool the hot compressed air and any water condensed in the cooling process is removed by the compressor moisture separators and automatic drain valves. Downstream of the compressors the air flows to air receivers to smooth out pressure surges. Breathing air purifiers are provided downstream of the receivers to purify the air to meet ANSI/CGA G-7.1 requirements. The purifier discharge lines join and supply breathing air to various locations in the Nuclear Annex and inside Containment.

NRC RAI 410.114

9.3.1.3 <u>Safety Evaluation</u> (CESSAR-DC Page 9.3-2)

<u>**INSERT 2:**</u>

The Instrument Air System, Station Air System, and Breathing Air stems are non-safety related systems with the exception of the ntainment isolation portion of the systems. The containment olation valves and associated piping are designated Safety Class Seismic Category I.

DELETE AND ADD INSERT 3

~~The instrument air compressors and air dryers can be manually powered by the Class 1E diesel generators during a loss of offsite power. This provision is made to facilitate shutdown, especially during a Control Room evacuation coincident with a loss of offsite power. The reliable power source for the compressors in this case is the Class 1E diesel generators, and the reliable cooling water source for the aftercoolers, intercoolers, and oil coolers is the Component Cooling Water System.~~

9.3.1.4 Inspection and Testing Requirements

The instrument air system preoperational testing and inspection is in accordance with intent of Regulatory Guide ~~1.80~~ 1.68.3 prior to initial operation. The air at the discharge of the air dryers is checked and verified to have an acceptable dew point. Periodically, the air at the filter discharge is tested for dew point and particulate contamination. Air samples are taken at selected remote locations on the instrument air system and checked for oil and particulate matter as recommended in Regulatory Guide ~~1.80~~ 1.68.3 and in accordance with ~~MC11.1-1976 (ISA-S7.3)~~ ANSI/ISA-S7.3-1975 (R1981). Adequate operating performance monitoring by the operator assures system integrity.

9.3.1.5 Instrumentation Requirements

Sufficient instrumentation is provided to monitor system performance and to control the system automatically or manually under all operating conditions.

NRC RAI 410.114

9.3.1.3 **Safety Evaluation** (CESSAR-DC Page 9.3-2a)

INSERT 3:

Inadvertent actuation of safety-related valves due to failure of the Instrument Air System will not cause any unsafe conditions that preclude achieving and maintaining safe shutdown.

The active safety-related valves having an instrument air supply are listed in Table 9.3.1-1, "Active Safety-Related Components Serviced by Instrument Air". These valves are designed to fail in the safe position on a loss of instrument air to the valve actuator. The fail safe position of these valves takes into account any inadvertent actuations which may occur from loss of instrument air, to insure the ability to achieve and maintain safe shutdown. This is evident from the following review of the safety function of the valves listed in Table 9.3.1-1 and the systems containing these valves.

As listed in Table 9.3.1-1, the majority of the pneumatically operated valves with an active safety function are containment isolation valves. By design, the containment isolation valves are required to close following a design basis event. These valves have been determined to be nonessential for achieving safe shutdown and are designed to fail in the closed position. Inadvertent closure of the air operated containment isolation valves due to a loss of instrument air would have no impact on the plant's ability to achieve and maintain safe shutdown.

Inadvertent closure of the main steam isolation valves (MSIVs) and main feedwater isolation valves (MFIVs) due to a loss of instrument air would cause a reactor trip. The Emergency Feedwater System (EFWS) and atmospheric dump portion of the Main Steam System would be available to bring the plant down to shutdown cooling entry conditions. Consequently, no unsafe conditions would result from inadvertent closure of these valves which would preclude achieving and maintaining safe shutdown.

The EFWS contains pneumatically operated valves with an active safety-related function. The steam supply isolation valves and steam supply bypass isolation valves permit steam flow to the steam driven emergency feedwater pump turbines. A loss of instrument air will cause these normally closed valves to fail safe in the open position allowing steam flow to the EFW turbines. Inadvertent opening of the valves due to a loss of instrument air will start the turbine driven pumps and thus does not render the EFWS inoperable. With the valves in a failed open position, initiation of the EFWS is possible. Therefore, a loss of instrument air to these valves will not result in an unsafe condition or impede safe shutdown.

NRC RAI 410.114

9.3.1.3 Safety Evaluation (CESSAR-DC Page 9.3-2a)

INSERT 3: (CONT'D)

Unintentional actuation of the active, air operated Component Cooling Water System (CCWS) valves due to a loss of instrument air will not restrict the plant's ability to achieve or maintain safe shutdown. The pneumatically operated CCWS valves which serve to isolate nonessential portions of the system are not required for safe shutdown. As nonessential isolation valves, they isolate portions of the CCWS which are not required for safe shutdown and are designed to fail closed. The air operated CCWS flow control valves are required to fail to the open position insuring system operability for safe shutdown and accident mitigation. Excessive flow is prevented by use of travel stops on the valves should they fail open.

The pressurizer spray control valves on the reactor coolant system are not required for safe shutdown. The safety depressurization system provides a safety grade means for depressurization to achieve safe shutdown.

The letdown isolation valve and letdown backup isolation valve on the Chemical and Volume Control System (CVCS) are system isolation valves and are not essential to achieving safe shutdown. These valves fail closed on loss of instrument air. This is their safe position which prevents further letdown should there be a break in the letdown line.

The instrument air compressors and air dryers can be manually powered by the Non-Class 1E Alternate AC Source Standby Power Supply during a loss of offsite power. This provision is made to facilitate shutdown, especially during a Control Room evacuation coincident with a loss of offsite power. The reliable power source for the compressors in this case is the Non-Class 1E Alternate AC Source Standby Power Supply, and the reliable cooling water source for the compressors is the component cooling water system.

Attachment ALWR-346

NRC RAI 410.114

Figure 9.3.1-1

Instrument Air System Flow Diagram

Note: (Reference drawing no. 1248-00-1607.00 F422-01 has been completely revised, see revision P2 for figure development)

TABLE 9.3.1-1 (Page 1 of 5)

ACTIVE SAFETY-RELATED COMPONENTS SERVICED BY INSTRUMENT AIR

COMPONENT NUMBER	CESSAR-DC FIGURE	DESCRIPTION	SAFETY-RELATED ACTIVE FUNCTION	NORMAL POSITION	LOSS OF AIR FAILED POSITION	SAFE POSITION
MAIN STEAM SYSTEM						
SG-140	10.1-2	Main Steam Isolation Valve	Containment Isolation	O	C	C
SG-141	10.1-2	Main Steam Isolation Valve	Containment Isolation	O	C	C
SG-150	10.1-2	Main Steam Isolation Valve	Containment Isolation	O	C	C
SG-151	10.1-2	Main Steam Isolation Valve	Containment Isolation	O	C	C
SG-183	10.1-2	MSIV Bypass Valve	Containment Isolation	C	C	C
SG-169	10.1-2	MSIV Bypass Valve	Containment Isolation	C	C	C
MAIN FEEDWATER SYSTEM						
SG-130	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-132	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-135	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-137	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-172	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-174	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-175	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
SG-177	10.1-2	Main Feedwater Isolation Valve	Containment Isolation	O	C	C
EMERGENCY FEEDWATER SYSTEM						
EF-108	10.4.9-1	Steam Supply Isolation Valve	Supply Steam to EFW Turb	C	O	O
EF-109	10.4.9-1	Steam Supply Isolation Valve	Supply Steam to EFW Turb	C	O	O

Attachment ALWR-346

NRC RAI 410.114

TABLE 9.3.1-1 (Page 2 of 5)

ACTIVE SAFETY-RELATED COMPONENTS SERVICED BY INSTRUMENT AIR

COMPONENT NUMBER	CESSAR-DC FIGURE	DESCRIPTION	SAFETY-RELATED ACTIVE FUNCTION	NORMAL POSITION	LOSS OF AIR FAILED POSITION	SAFE POSITION
EMERGENCY FEEDWATER SYSTEM (CONT'D)						
EF-112	10.4.9-1	Steam Supply Bypass Isol Valve	Priming Steam to EFW Turb	C	O	O
EF-113	10.4.9-1	Steam Supply Bypass Isol Valve	Priming Steam to EFW Turb	C	O	O
COMPONENT COOLING WATER SYSTEM						
CC-100	9.2.2-1	CCWS Hx 1A Bypass Valve	System Isolation	C	C	C
CC-101	9.2.2-1	CCWS Hx 1B Bypass Valve	System Isolation	C	C	C
CC-102	9.2.2-1	Non Esstl Spply Hdr Isol Valve	Isol Non Esstl CCW Flow	O	C	C
CC-103	9.2.2-1	Non Esstl Rtrn Hdr Isol Valve	Isol Non Esstl CCW Hdrs	O	C	C
CC-110	9.2.2-1	SDC Hx 1 Control Valve	Flow Control	C	O	O
CC-112	9.2.2-1	Spent Fuel Pool CW Ctrl Valve	Flow Control	C	C	O
CC-122	9.2.2-1	Non Esstl Spply Hdr Isol Valve	Isol Non Esstl CCW Flow	O	C	C
CC-123	9.2.2-1	Non Esstl Rtrn Hdr Isol Valve	Isol Non Esstl CCW Hdrs	O	C	C
CC-200	9.2.2-1	CCWS Hx 2A Bypass Valve	System Isolation	C	C	C
CC-201	9.2.2-1	CCWS Hx 2B Bypass Valve	System Isolation	C	C	C
CC-202	9.2.2-1	Non Esstl Spply Hdr Isol Valve	Isol Non Esstl CCW Flow	O	C	C
CC-203	9.2.2-1	Non Esstl Rtrn Hdr Isol Valve	Isol Non Esstl CCW Hdrs	O	C	C
CC-210	9.2.2-1	SDC Hx 2 Control Valve	Flow Control	C	O	O
CC-212	9.2.2-1	Spent Fuel Pool CW Ctrl Valve	Flow Control	C	O	O
CC-222	9.2.2-1	Non Esstl Spply Hdr Isol Valve	Isol Non Esstl CCW Flow	O	C	C

Attachment ALWR-346

NRC RAI 410.114

TABLE 9.3.1-1 (Page 3 of 5)

ACTIVE SAFETY-RELATED COMPONENTS SERVICED BY INSTRUMENT AIR

COMPONENT NUMBER	CESSAR-DC FIGURE	DESCRIPTION	SAFETY-RELATED ACTIVE FUNCTION	NORMAL POSITION	LOSS OF AIR FAILED POSITION	SAFE POSITION
COMPONENT COOLING WATER SYSTEM (CONT'D)						
CC-223	9.2.2-1	Non Esstl Rtrn Hdr Isol Valve	Isol Non Esstl CCW Hdrs	O	C	C
REACTOR COOLANT SYSTEM						
RC-100E	5.1.2-3	Pressurizer Spray Ctrl Valve	System Isolation	C	C	C
RC-100F	5.1.2-3	Pressurizer Spray Ctrl Valve	System Isolation	C	C	C
CHEMICAL AND VOLUME CONTROL SYSTEM						
CH-505	9.3.4-1	RCP CBO Containment Isol Valve	Containment Isolation	O	C	C
CH-506	9.3.4-1	RCP CBO Containment Isol Valve	Containment Isolation	O	C	C
CH-515	9.3.4-1	Letdown Isolation Valve	System Isolation	O	C	C
CH-516	9.3.4-1	Letdown Backup Isolation Valve	System Isolation	O	C	C
CH-523	9.3.4-1	Letdown Containment Isol Valve	Containment Isolation	O	C	C
CH-560	9.3.4-1	RDT Isolation Valve	Containment Isolation	O/C	C	C
CH-561	9.3.4-1	RDT Suction Isolation Valve	Containment Isolation	O/C	C	C
CH-580	9.3.4-1	RMWS to RDT Isolation Valve	Containment Isolation	C	C	C
SAFETY INJECTION SYSTEM						
SI-682	6.3.2-1A	SIT Fill/Drain CIV	Containment Isolation	C	C	C

Attachment ALWR-346

NRC RAI 410.114

TABLE 9.3.1-1 (Page 4 of 5)

ACTIVE SAFETY-RELATED COMPONENTS SERVICED BY INSTRUMENT AIR

COMPONENT NUMBER	CESSAR-DC FIGURE	DESCRIPTION	SAFETY-RELATED ACTIVE FUNCTION	NORMAL POSITION	LOSS OF AIR FAILED POSITION	SAFE POSITION
CONTAINMENT PURGE SYSTEM						
		Hi Vol Cont Purge Sys Spply #1				
–	9.4-6	Outside	Containment Isolation	C	C	C
–	9.4-6	Inside	Containment Isolation	C	C	C
		Hi Vol Cont Purge Sys Spply #2				
–	9.4-6	Outside	Containment Isolation	C	C	C
–	9.4-6	Inside	Containment Isolation	C	C	C
		Hi Vol Cont Purge Sys Exhst #1				
–	9.4-6	Outside	Containment Isolation	C	C	C
–	9.4-6	Inside	Containment Isolation	C	C	C
		Hi Vol Cont Purge Sys Exhst #2				
–	9.4-6	Outside	Containment Isolation	C	C	C
–	9.4-6	Inside	Containment Isolation	C	C	C
		Lo Vol Cont Purge Sys Supply				
–	9.4-6	Outside	Containment Isolation	C	C	C
		Lo Vol Cont Purge Sys Exhaust				
–	9.4-6	Outside	Containment Isolation	C	C	C
–	9.4-6	Inside	Containment Isolation	C	C	C

NRC RAI 410.114

TABLE 9.3.1-1 (Page 5 of 5)

ACTIVE SAFETY-RELATED COMPONENTS SERVICED BY INSTRUMENT AIR

COMPONENT NUMBER	CESSAR-DC FIGURE	DESCRIPTION	SAFETY-RELATED ACTIVE FUNCTION	NORMAL POSITION	LOSS OF AIR FAILED POSITION	SAFE POSITION
CONTAINMENT COOLING SYSTEM						
		CVU Cond Drn Hdr CIV				
-	-	Outside	Containment Isolation	O	C	C
-	-	Inside	Containment Isolation	O	C	C

Attachment ALWR-346

NRC RAI 410.114

Question 410.115

a. The figures provided in Section 9.3.3 do not indicate where changes in system component safety classification occur. In particular, Figure 9.3.3-1 does not show the classification for the containment isolation valves and penetrations. Additionally, the check valves which provide backflow protection for areas containing safety related equipment should be Safety Class 3 and Seismic Category I. The classification for these components should also be provided on the appropriate figures.

b. Table 3.2-1 identifies the sump pumps for the reactor building subsphere as being Safety Class 3 and Seismic Category I. The figures in Section 9.3.3 do not indicated that these pumps are so classified. Modify both the text and the figures to indicate that these sump pumps are Safety Class 3 and Seismic Category I. Additionally, the instrumentation required to control these pumps must also be identified as being safety related since the pumps provide flood protection.

c. The text and Figure 11.2 indicate that there is a separate equipment drain system, discharging to the Equipment Waste Tanks. However, the drainage system (with the exception of the Diesel Generator Sump Pump System) is not discussed to the same level of detail as the floor drainage system. Similarly, several inputs to the drain headers are identified in the several sheets of Figure 11.2-1 for which no system description or P&IDs are provided, particularly the Turbine Building and Radwaste Building drain systems. Identify whether these portions of the drain system are to be included within the scope of the CESSAR System 80+. If so, provide system descriptions, safety evaluations, and P&IDs for these portions of the system. If these portions are to be considered beyond the scope of the standardized design, provide a set of interface criteria for the plant specific applicant that will allow for the design of a system that will meet the requirements identified in SRP Section 9.3.3.

d. Figure 11.2-1 refers to Auxiliary and Fuel Building discharges to the equipment and floor drain headers. This is not consistent with the figures in Section 9.3.3 which refer to Nuclear Annex and subsphere sumps. Verify that the references to the Auxiliary and Fuel Building discharges are in fact the discharges from the areas identified in Section 9.3.3.

Response 410.115

a. The P&IDs in Section 9.3.3 will be revised to include safety classifications of components and piping. The Safety Class 3 designation will also be shown for the backflow check valves provided for flood protection of areas containing safety-related equipment. These revisions will be included in a future amendment to CESSAR-DC.

b. CESSAR-DC Section 9.3.3 will be revised to indicate that the Reactor Building Subsphere floor drain sump pumps and their associated instrumentation are classified as Safety Class 3. As stated above the P&IDs for the Reactor Building Subsphere floor drain system will also be revised to reflect the appropriate safety classification of the system. These revisions will be included in a future amendment to the System 80+™ CESSAR-DC.

c. The Equipment and Floor Drain System is within the scope of System 80+. As the text and Figure 11.2-1 indicates, the equipment drain system is a segregated drain system to ensure separation of equipment waste-quality liquid. As stated in CESSAR-DC Section 11.2.2.1, Figure 11.2-1 is a simplified process flow diagram intended to show general inputs to a equipment waste header and subsequently the equipment waste tanks. The level of detail provided is based on the safety significance of the subsystems. The safety evaluation for the Equipment and Floor Drainage System is provided in Section 9.3.3.3 of CESSAR-DC. The turbine building and radwaste building equipment and floor drainage systems are discussed in CESSAR-DC Sections 9.3.3.2.4 and 9.3.3.2.5, respectively. Additional information concering the turbine building floor drain sump is given in CESSAR-DC Section 9.3.3.2. The design commitments for these portions of the system are given in the above CESSAR-DC Sections.

d. Figure 11.2-1 will be revised to accurately reflect the names of the designated inputs to the floor drain waste header and tanks. These revisions will be consistent with the text and figures of CESSAR-DC Section 9.3.3. These revisions will be included in a future amendment to the System 80+™ CESSAR-DC.

NRC RAI 410.115

Reactor coolant quality water from valve and equipment leakoffs, drains, and reliefs within Containment are collected in the Reactor Coolant Drain Tank. The tank is part of the CVCS System and is described in Section 9.3.4.

Low radioactivity condensate from the Containment Coolers is routed to and collected in the Containment Cooler Condensate Tanks. Figure 11.2-1, Sheet 7 is a simplified flow diagram of the containment cooler condensate liquid waste management system. Condensation from the coolers collects in drip pans under the coolers, runs into a header that connects all the coolers, leaves Containment and enters one of the condensate tanks.

9.3.3.2.2 Reactor Building Subsphere

Figure 9.3.3-2 shows the flow diagram for the Reactor Building Subsphere floor drains. The Reactor Building Subsphere floor drainage system is divided into four separate drainage subsystems, one subsystem for each quadrant of the building. No common floor drain lines are provided between quadrants or divisions.

Each quadrant is provided with a floor drain sump, independent of the sumps serving the other quadrants. The separate floor drain headers empty into the sumps, each of which is equipped with two 100%-capacity sump pumps. The sump pumps operating automatically under control of level instrumentation in the sump, pump the collected waste from the sump to the Floor Drain Waste Tanks. I

The Reactor Building Subsphere floor drain sump pumps are safety grade pumps required to collect leakage from the Engineered Safety Feature (ESF) pumps and to prevent flooding of the ESF pump rooms. The pumps are normally powered from their respective quadrants electrical channel. In the event of loss of offsite power, the sump pumps are powered from the diesel generators.

The Reactor Building Subsphere is physically separated into quadrants by walls containing no unsealed penetrations up to elevation 65+0. This assures each train of safety-related equipment necessary for safe shutdown is isolated from a potential flood occurring in an adjacent quadrant. Above elevation 65+0 the subsphere is physically separated divisionally such that a potential flood in one division is prevented from flooding the other division. Curbs are provided at the higher elevations to further aid in the prevention of cross-flooding.

Backwater valves throughout the floor drain system prevent backflow into safety-related equipment areas. Backwater valves to areas containing safety-related equipment are Safety Class 3.

The Diesel Generator Building Sump Pump System is detailed in Section 9.5.9.

The Reactor Building Subsphere equipment drains are directed to the Equipment Drain Tank or the Equipment Waste Tanks depending on waste quality and activity.

9.3.3.2.3 **Nuclear Annex**

The Nuclear Annex is composed of five areas:

1. Control Complex Area
2. Fuel Pool Area
3. Maintenance/Outage Area
4. Main Steam Valve Houses
5. Diesel Generator Buildings

Figure 9.3.3-3 is the flow diagram for the Nuclear Annex floor drainage system. The Nuclear Annex is divisionally separated by walls with no unsealed penetrations up to elevation 65+0. The Nuclear Annex floor drainage system is divisionally separate having no common drain lines between divisions. Each division is provided with its own floor drain sump which collects floor drainage from its respective division. Each sump contains two full capacity sump pumps which pump the collected sump wastes to the Floor Drain Waste Tanks.

The equipment and floor drains of the Diesel Generator Buildings are separate from the other Nuclear Annex drains. Floor drain wastes collect in the Diesel Generator floor sump which is equipped with two full capacity safety grade sump pumps. These pumps are required to prevent flooding of the diesel generators and are powered from the diesel generators in the event of loss of offsite power. Floor drain wastes are directed to the Floor Drain Waste Tanks. I

The Main Steam Valve House is provided with its own floor drain sump to collect floor drainage within this area of the Nuclear Annex.

Recoverable reactor coolant quality water outside the Containment Building from selected equipment drains, valve leakoffs, and equipment reliefs drains to the Equipment Drain Tank in the Nuclear Annex.

The emergency feedwater pump rooms are physically separated from the Reactor Building Subsphere. Access to these rooms is provided from the Nuclear Annex. The Equipment and Floor Drainage System collects and detects Emergency Feedwater System (EFWS) leakage which may originate in each EFW pump room and areas containing EFW system piping where a moderate or high energy pipe rupture is postulated. The EFW pump room floor

9.3.3.2.5 Radwaste Building

The Radwaste Building equipment and floor drains are segregated and collected separately. The Radwaste Building is provided with a floor drain sump which collects floor drainage from the building. The sump is provided with two full capacity sump pumps which automatically pump the collected waste to the Floor Drain Waste Tanks.

Equipment waste from the Radwaste Building is directed to the Equipment Waste Tanks.

9.3.3.3 Safety Evaluation

The Equipment and Floor Drainage System has been carefully and rigorously designed to accomplish the necessary segregation of liquid wastes as required by the Liquid Radwaste System.

Drains are sized for draining of their corresponding equipment. Sump sizes and sump pump capacities are compatible to eliminate undesirable sump pump cycling operation.

Sump pump capacities are sized large enough to handle the maximum leakage rate into their respective sumps. Operators will be alerted of abnormal quantities of water being released to the Equipment and Floor Drainage System by comparing pump discharge pressures and flows to the calculated and experimental flows and pressure drops. Leakage detection devices will also be used in applicable component areas. I

All piping capable of flooding components needed for safe shutdown and accident mitigation is designed for Seismic Category I. This minimizes the potential for flooding safety-related components.

and associated instrumentation — Safety Class 3

The Reactor Building Subsphere floor drain sumps ~~collect seal leakage from the ESF pumps and the~~ pumps are ~~safety grade~~ to prevent flooding of the ESF pump rooms. The pumps are powered from the diesel generators in the event of loss of offsite power.

~~The Diesel Generator Building floor drain sump pumps are safety grade to prevent flooding of the diesel generators. These pumps are also powered from the diesel generators in the event of loss of offsite power.~~

The Nuclear Annex and Reactor Building Subsphere divisions are physically separated such that flooding of one division will not affect the other division. The Reactor Building Subsphere is further separated by quadrants up to elevation 65+0. This assures train separation of safety-related equipment necessary

Question 410.116
(9.4.1)

a. The system diagrams indicate that each fresh air intake is isolated from ductwork used by the other inlet by a single damper. Reconcile this design with the single failure criterion.

b. The system diagrams indicate that the by-pass for the emergency filter trains are separated from the balance of the system by a single damper. Provide justification as to why two dampers not needed to meet the single failure criterion?

c. Provide P&IDs showing redundant smoke, toxic gas and radiation monitors for the control room system.

d. Table 9.4-2 presents flow data for control room-related areas which appear to be flows through recirculation units located in those areas. Is this the proper interpretation of the data for the control room mechanical equipment room, the operation support center, the men and women change rooms, the break room, the shift assembly and offices area, the radiation access control area and the essential electrical room?

e. What are the design values for air flow rates for all flow paths in the control building for normal and accident conditions? Your response should include areas shown in Figure 9.4-2, such as the essential electrical room, for which normal inlet flow is indicated but for which the exit flow path is not identified.

f. Are fresh air intakes protected against the effects of high winds, rain, snow, ice and trash?

g. Regulatory Guide 1.52 specifies placement of HEPA filters before and after carbon adsorbers in the atmospneric clean-up system. Provide a justification for the use of a single HEPA filter in the proposed design.

h. Are the ducts leak tested in accordance with ASME/ANSI-N509?

i. What is the maximum hydrogen concentration in battery rooms served by this system?

j. This section does not provide an explicit statement as to the seismic category of the control building and the control building does not appear in the list of structures in Table 3.2-1. What is the seismic category of the control building?

k. Table 3.2-1, titled, Classification of Structures, Systems and Components, does not list dampers for the control building system. Is the table, as provided in Amendment 1, complete for all ventilation systems and all components? If not, provide a complete listing of ventilation system components required in Table 3.2-1.

Response 410.116
(9.4.1)

a. The Control Room HVAC System is revised to provide two isolation dampers at the outside air intakes. A revision to CESSAR-DC Figure 9.4-2 is attached.

b. The Control Room HVAC System is revised to provide two air operated dampers designed to fail closed in the filter train bypass. A revision to CESSAR-DC Figure 9.4-2 is attached.

c. The smoke, toxic gas and radiation monitors for the Control Room HVAC System are shown on the attached mark-up of Figure 9.4-2.

d. Yes, they are the flows through the recirculation units for their respective areas.

e. The flows in Table 9.4-2 for areas such as essential electrical rooms are recirculation flows, common for normal and accident conditions. The inlet flow path is provided for smoke purge and air replacement using smoke fans.

f. The fresh air intakes are protected against the effects of tornado-generated missiles, wind-generated missiles, rain, snow, ice or trash.

g. The current design provides for a post-filter, which is a HEPA, section downstream of the carbon adsorbers for removal of carbon fines from the air stream.

h. The ductwork is leak tested in accordance with ASME/ANSI-N509-1989.

i. The battery rooms have exhaust systems designed to maintain the hydrogen concentration below two percent.

j. The control building is a Seismic Category I structure. The control building is included in the Nuclear Annex Building Structure in Table 3.2-1.

k. The Table 3.2-1 will be completed and included in a future amendment to CESSAR-DC.

These responses will be incorporated into CESSAR-DC Section 9.4.1 in a future amendment. A markup of this section is attached.

In the event of a fire, area fire detectors will sound an alarm in the control room and the supply fan may be deactivated manually if required. Smoke removal is then manually initiated from the Control Room or the Remote Shutdown Room by a smoke exhaust fan, outside makeup air and associated ductwork and control dampers.

The Containment, the Subsphere area, the Fuel Building, the Nuclear Annex, and the two Diesel Buildings are ventilated, heated and cooled with 100% outside air systems. The supply and exhaust fans are available for smoke control. The Control Building area has dedicated smoke control fans. The Turbine Building ventilating fans are available for smoke control.

Table 9.4-3 tabulates the RCS insulation heat loads within the Containment. I

Table 9.4-4 tabulates the data used for Chapter 15 offsite and control room dose analysis.

Table 9.4-5 tabulates the heat loads from NSSS Support Structures within the Containment.

9.4.1 CONTROL BUILDING VENTILATION SYSTEM

9.4.1.1 Design Basis

The Control Building Ventilation and Air Conditioning Systems are designed to maintain the environment in the control room envelope and balance of control building within acceptable limits for the operation of unit controls, for maintenance and testing of the controls as required, and for uninterrupted safe occupancy of the control building area during post-accident shutdown. These systems are designed in accordance with the requirements of General Design Criteria 2, 4, 5, 19, and 60. Refer to Section 6.4 for further information regarding control room habitability. The control building consists of the main control room, the technical support center, the computer room, the electric switchgear rooms, offices, and mechanical support equipment areas as shown on Figure 9.4-2. The Control Building is a seismic category I structure. E

The control room, and other support areas are designed to maintain approximately 73°F to 78°F and 20% to 60% maximum relative humidity. The battery room is designed to maintain approximately 77 F. The mechanical equipment room is designed to maintain a maximum temperature of 104°F. All other areas are designed to maintain a maximum temperature of 85°F. These conditions are maintained continuously during all modes of operation for the protection of instrumentation and controls, and for the comfort of the operators. Outdoor design conditions are given in Table 9.4-1.

Continuous pressurization of the control room and the connecting offices is provided to prevent entry of dust, dirt, smoke, and radioactivity originating outside the pressurized zones in accordance with the intent of NUREG-0700 requirements. Pressurization is maintained slightly positive relative to the pressure outdoors and in surrounding areas.

Outside air for pressurization is taken from either of two locations such that a source of uncontaminated air is available regardless of wind direction. Each air intake is located as far away from the diesel generator exhaust as practical. All outside air is filtered.

Each outside air intake location is monitored for the presence of radioactivity, toxic gases, e.g., chlorine, and products of combustion. Isolation of the outside air intake occurs automatically upon indication of high radiation level, high chlorine concentration or smoke concentration in the intake. Should both intakes close, the operator can override the intake monitors and by inspection of the control room readouts select the least contaminated intake. This will ensure pressurization of the control room.

Each outside air intake is provided with ~~a~~ redundant tornado isolation dampers to prevent depressurization of the control room and the control room area during a tornado. E

All essential air conditioning and ventilation equipment is able to perform required safety functions assuming the worst single failure of an active component concurrent with a loss of offsite power.

All essential air conditioning and ventilating equipment, ductwork and supports are designed to withstand the safe shutdown earthquake. In addition, this equipment is protected from the effects of internally generated missiles, pipe breaks and water spray. Essential electrical components required for the heating, cooling, and pressurization of the control room during accident conditions are connected to emergency Class 1E standby power.

Instrumentation is provided for the air conditioning systems to control and indicate the temperature, and to indicate radioactivity levels. Early warning ionization-type smoke detectors are located in the supply, return and outside air ductwork serving the Control Room Area Ventilation System.

particulates and potential radioactive iodines from a portion of the return air, and delivers the filtered air to the inlet of the main air-handling unit.

The Technical Support Center air-handling system consists of an air-handling unit, return air and smoke purge fans, and an emergency filter unit. The computer room air-handling system consists of two 100% air-handling units and associated fans. Both the Technical Support Center and computer room air-handling systems are non-safety and non-seismic. E

The balance of control building air-handling systems consists of two redundant air-handling units, each with roughing filters, essential chilled water cooling coils and fans serving Division I electrical rooms, channel A and channel C. Two equal units are serving Division II channel B and D. Each Division will function with one of the redundant air handling units delivering filtered, conditioned air to the various electrical equipment rooms. Chilled water is supplied from the essential chilled water system. Each Division also contains redundant battery rooms with fan operating continuously to ~~prevent buildup of hydrogen fumes.~~ maintain the hydrogen concentration below two percent. The safe shutdown area is served by Division II. I

Return air from the various essential electrical equipment areas is mixed with a portion of outside air for ventilation, is filtered and conditioned in the air-handling unit, and is delivered to the rooms through supply ductwork. Duct-mounted heating coils provide final adjustments to temperature in selected equipment rooms. E

The Operation Support Center, Men's Change, Women's Change, Break Room, Shift Assembly and Offices, Radiation Access Control two non-essential Elec. Rms, CEDM control and Cas. and Sec. Group areas all are served by an individual air handling unit consisting of a centrifugal fan, non essential chilled water coil and roughing filter. I

As shown on Figure 9.4-2 all of these areas can receive outside air from the cleanest of two sources described for the control room. The roof exhaust fan shown serving the men's change, the women's change and the break room is actually located approximately 80 feet from the outside air intake.

9.4.1.3 Safety Evaluation

The air-handling system serving the control room proper consists of two completely redundant, independent, full-capacity cooling systems. Each system is powered from independent, Class 1E power sources and headered on separate essential chilled water systems. E

Equipment capacities are selected based on conservative evaluations of heat-producing equipment and conservative assumptions of adjacent area temperatures. Normally, the control room temperature will be maintained at approximately 74°F. The design basis upper limit of 85°F is set to insure reliable operation of the electronic equipment.

Both, the Technical Support Center and computer room air-handling systems are non-safety and non-seismic. Failure of either does not compromise other safety-related air-handling systems or prevent safe shutdown.

The balance of the control building air-handling system consists of two independent, full capacity systems. Each system serves the associated train of essential electrical equipment areas. Each system is powered from independent Class 1E power sources and served from separate essential chilled water systems. Equipment capacities are based on conservative evaluations of heat-producing equipment and conservative assumptions of surrounding area temperatures. Normally, the electrical equipment areas will be maintained at approximately 85°F. The design basis upper limit of 104°F is based on standard ratings for electrical equipment.

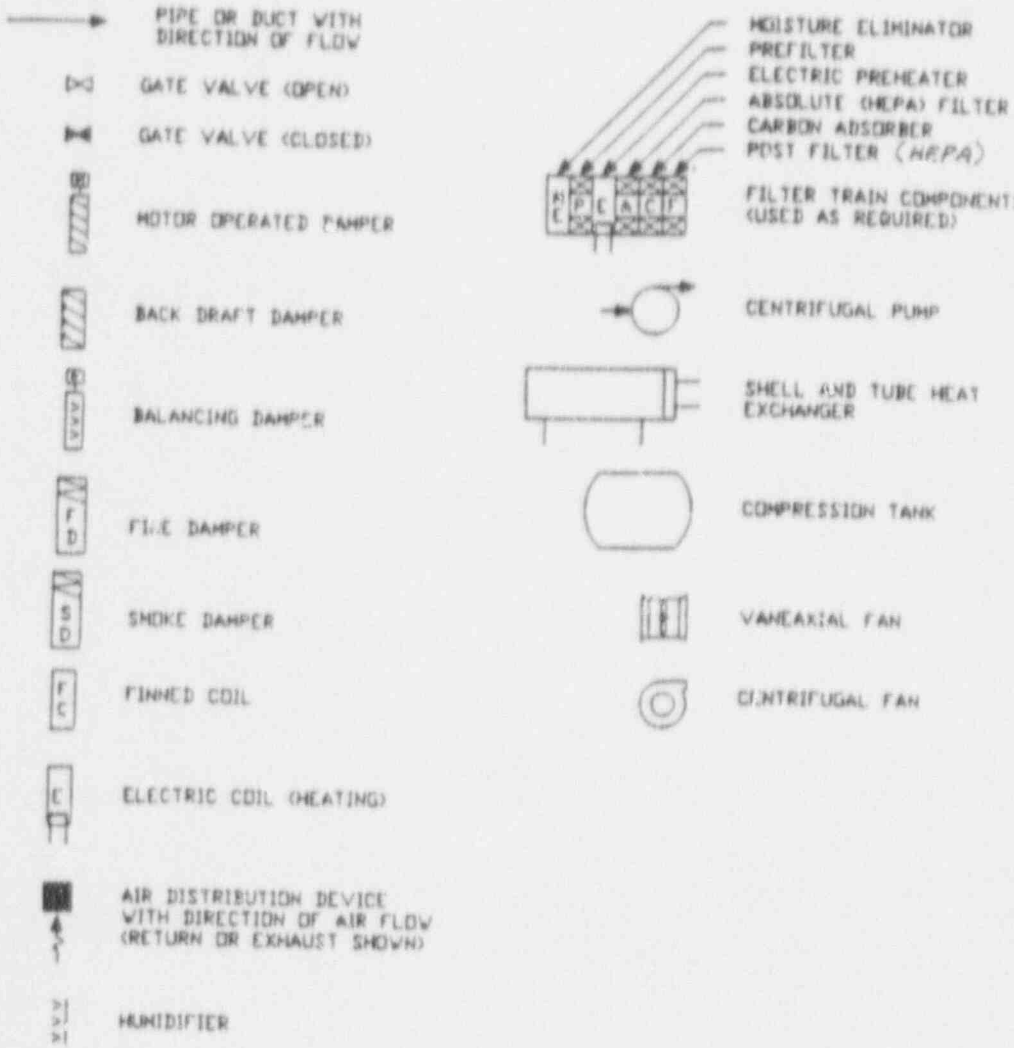
The control room emergency recirculation system consists of two completely redundant, independent, full-capacity filtration systems. Each system is powered from separate Class 1E power sources, and is capable of providing the required cleanup effect. The dose assessment assumes the failure of one complete train of the emergency circulation system. E

rain, snow, ice or trash

All essential components of the control equipment area ventilation systems are designed as Seismic Category I equipment, and will remain functional following a safe shutdown earthquake. Intake and exhaust structures are protected from tornado-generated ~~or wind-generated~~ missiles. missiles Isolation valves in the main control room intake, relief and exhaust points are designed to withstand pressure differentials of a postulated tornado. No components are subjected to flooding by virtue of the location within the control building.

Redundant components are physically separated, and none are subjected to pipe break effects such as pipe whip or jet impingement. Components are designed and constructed so that exposure to a water-spray environment will not prevent performing the required safety function.

All essential components of the control equipment area ventilation systems are powered from Class 1E, diesel-backed power sources. Capacity of the control room air-handling system



Amendment I
December 21, 1990

SYSTEM 80+™	GRAPHICAL SYMBOLS FOR AIR FLOW DIAGRAMS	Figure 9.4-1

9.4.2 Fuel Building Ventilation System

Question 410.117

a. Provide P&IDs which show redundant monitors.

b Does the design allow for in-service testing as specified the SRP?

c. System diagrams indicate that the filtration system by-passes employ a single damper. How is this feature reconciled with the single failure criteria?

d. Table 8.3.1-2, titled Division I Class 1E Loads, does not list the fuel building ventilation system fans or filtration system heaters. Is this table complete?

e. Regulatory Position C.2 of Regulatory Guide 1.52 specifies use of HEPA filters before and after carbon adsorbers. Provide a justification for the use of a single HEPA filter in the proposed design.

f. Is testing in accordance with ASME/ANSI AG-1-1988 equivalent to testing in accordance with ASME/ANSI N509 & N510?

Response 410.117

a. There is only one radiation detector provided as shown in the attached P&ID consistent with the guidance in Table 1 in Regulatory Guide 1.97.

b. The design does not have any component under the jurisdiction of the ASME code referred to in the SRP. The in-service testing program will be implemented in accordance with 10 CFR 50, Appendix B, Section XI to allow in-service testing as required by applicable standards and codes.

c. The bypass damper will be administratively locked closed and the Fuel Building Ventilation System will be in operation whenever irradiated fuel handling operations above or in the fuel pool are in progress.

d. The current tables 8.3.1-2 and 8.3.1-3 will be revised as shown in the attached markup. The fuel building ventilation system fans are listed as fuel pool exhaust fans. The fuel building filtration system heaters will be listed in the tables as fuel pool exhaust filter train heating elements.

e. HEPA filters will be used before and after carbon adsorbers. The post filter reflected in the design is a HEPA filter downstream of the carbon adsorber.

f. Testing section of ASME/ANSI AG-1-1988 is incomplete. ASME/ANSI N509 and N510 are referenced in Section 9.4.2.1.1.

This response is being incorporated into CESSAR-DC Sections 9.4.2 and 8.3.1. A markup of these sections is attached.

B. Maintain a suitable access and working environment for personnel.

C. Maintain the fuel handling and storage building at a negative pressure relative to the atmosphere to minimize outleakage.

The fuel-handling building exhaust system is designed to mitigate the consequences of a postulated fuel-handling accident. Dose at the site boundary shall be well within the values of 10 CFR Part 100, consistent with the Standard Review Plan 15.7.4.

The exhaust side of the Fuel Handling Area Ventilation System consists of two 100 percent exhaust systems. Each exhaust system consists of one 100 percent capacity filter train and fan. This meets the single failure criterion. Switchcover between filter trains is accomplished manually by the operator. Electrical and control component separation is maintained between trains.

All essential fans, filters, dampers, ductwork and supports are designed to withstand the safe shutdown earthquake.

Essential electrical components required for ventilation of the fuel handling area during accident conditions are connected to emergency Class 1E standby power. E

In order to control airborne activity, the ventilation air is generally supplied directly to the clean areas and exhausted from the potentially contaminated areas, creating a positive flow of air from the clean areas to the potentially contaminated areas.

INSERT 1

~~The~~ Fuel Building Ventilation System will be in operation whenever irradiated fuel handling operations above or in the fuel pool are in progress. The design temperature range for the fuel building is 40°F to 104°F. I

The Fuel Building Ventilation System is located completely within a Seismic Category I structure and all essential components (exhaust filter trains, exhaust fans, exhaust ductwork) are fully protected from floods and tornado missile damage, internal missiles, pipe breaks and whip, jet impingment and interaction with non-seismic systems in the vicinity. The outside air intake opening for the ventilating air supply unit is protected by missile shields above and in front of the opening. E I E

This system is designed in accordance with the requirements of General Design Criteria 2, 5, 60, and 61.

Insert 1

The bypass damper will be administratively locked closed and the.....

Attachment ALWR-346

RAI 410.117

Amendment I
December 21, 1990

SYSTEM 80+™	GRAPHICAL SYMBOLS FOR AIR FLOW DIAGRAMS	Figure 9.4-1

RAI 410.117

TABLE 8.3.1-2 (Cont'd)

(Sheet 7 of 21)

*DIVISION I CLASS 1E LOADS

Equipment Item	Component # Per Bus	Volts	Component(s) Individual Estimated Rated HP (Note N)	pf	Motor Efficiency	Total Component Equivalent Load (KW)	Loss of Offsite Power Load Division I	DBA/LOOP Load Division I
Essential Chiller Pump 1	1	480	13 BHP	0.9	0.9	10.8	10.8	10.8
Channel A Elev. 50' Essential Instrumentation and Equipment Room Ventilation Unit	1	480	10 BHP	0.9	0.9	8.3	8.3	8.3
Channel C Elev. 50' Essential Instrumentation and Equipment Room Ventilation Unit	1	480	10 BHP	0.9	0.9	8.3	8.3	8.3
Channel A Elev. 65' Essential Electrical Equipment Room Ventilation Unit	1	480	3 BHP	0.9	0.9	2.5	2.5	2.5
Channel C Elev. 65' Essential Electrical Equipment Room Ventilation Unit	1	480	3 BHP	0.9	0.9	2.5	2.5	2.5
Fuel Pool Exhaust Filter Train Heating Element	1	480	116 KW	1.0	—	116	0	0

I

TABLE 8.3.1-3 (Cont'd)

(Sheet 7 of 21)

*DIVISION II CLASS 1E LOADS

Equipment	Component # Per Bus	Volts	Component(s) Individual Estimated Rated HP (Note N)	pf	Motor Efficiency	Total Component Equivalent Load (KW)	Loss of Offsite Power Load Division II	DBA/LOOP Load Division II
Essential Chiller Pump 2	1	480	13 BHP	0.9	0.9	10.8	10.6	10.8
Channel B Elev. 50' Essential Instrumentation and Equipment Room V_ntilation Unit	1	480	10 BHP	0.9	0.9	8.3	8.3	8.3
Channel D Elev. 50' Essential Instrumentation and Equipment Room Ventilation Unit	1	480	10 BHP	0.9	0.9	8.3	8.3	8.3
Channel B Elev. 65' Essential Electrical Equipment Room Ventilation Unit	1	480	3 BHP	0.9	0.9	2.5	2.5	2.5
Channel D Elev. 65' Essential Electrical Equipment Room Ventilation Unit	1	480	3 BHP	0.9	0.9	2.5	2.5	2.5
Fuel Pool Exhaust Filter Train Heating Element	1	480	116 KW	1.0	—	116	0	0

I

9.4.4 Diesel Building Ventilation System

Question 410.118

a. Provide a diagram that includes the intake and exhaust vents, fans, dampers, heating/cooling elements, filters and other major system components. The diagram should provide some indication that air flow patterns will provide effective heat transfer to the exhaust air.

b. What is the elevation of the fresh air intake vents?

c. Is the building built to Seismic Category I standards?

d. Provide a description of the diesel generator space heaters identified in Table 8.3.1-2.

Response 410.118

a. Attached are the Air Flow Diagrams for the Diesel Building Ventilation System identifying the major components for NRC review. The System 80+™ General Arrangement Drawings are currently being revised. The revision will include location of all major components within the Diesel Generator Building. The revised general arrangement drawings will be included in a future CESSAR-DC update.

b. Fresh air intake vents for the diesel building ventilation system will be shown on the revised general arrangement drawings.

c. Yes, the building will be built to Seismic Category I standards. It is classified as Seismic Category I in Table 3.2-1 of CESSAR-DC.

d. The diesel generator space heaters are electric space heaters carrying an electric current through a resistance coil with a fan blowing air over the coil. They are wired in such a way that the coil is de-energized when the fan is not running. Their location is selected to avoid potential fire hazards. Upon failure of the diesel generator space heater to maintain the diesel room temperature above 40°F, the associated diesel generator is started administratively to provide a substitute safety-related source of heat.

This response is being incorporated into CESSAR-DC Section 9.4.4. A markup of this section is attached.

When the diesel generator is shut down, the ventilation system can be manually activated if necessary to provide cooling for maintenance or testing access. A low room temperature setpoint will shut down all fans in order to limit the minimum room temperature to 40°F and prevent freezing. Unit heaters will be installed to hold the room temperature above 40°F. E I

A missile barrier is provided over each air intake and exhaust louver to prevent the penetration of a missile into either diesel generator building. Intake and exhaust ducts are protected by appropriate security barriers.

9.4.4.3 Safety Evaluation

Each Diesel Building Ventilation System automatically maintains a suitable environment in each diesel enclosure under all operating conditions. E

Each diesel generator building ventilation system has sufficient cooling capacity to maintain the diesel room at 120°F or below with the diesel operating at rated load and with ambient outside design air temperature as shown in Table 9.4-1.

~~Unit~~ Diesel generator space heaters are cycled as necessary to maintain a minimum temperature of 40°F for freeze prevention. Add insert 1 Heat losses from equipment are conservatively estimated based on calculations and operating experience. I

A single failure will not prevent the diesel generator building ventilation system from performing the intended heat removal function. Each ventilation train is powered by a Class 1E electrical system capable of being fed from the associated diesel generator.

Essential components of the diesel generator building ventilations system are designed to Seismic Category I requirements and will remain functional following a safe shutdown earthquake. E

Diesel generator ventilation trains are located in separate buildings above the respective diesel generators. Each penetration into the building is provided with protection from external missiles. No high or moderate energy piping is located in the vicinity of the ventilation equipment or controls.

9.4.4.4 Inspection and Testing Requirements

Performance characteristics of the diesel building ventilation system are verified through the following qualification testing of essential components:

Insert 1

The diesel generator space heaters are electric space heaters carrying an electric current through a resistance coil with a fan blowing air over the coil. They are wired in such a way that the coil is de-energized when the fan is not running. Their location is carefully selected to avoid potential fire hazards. Upon failure of the diesel generator space heater to maintain the diesel room temperature above 40°F, the associated diesel generator is started administratively to provide a substitute safety-related source of heat.

9.4.5 Subsphere Building Ventilation System

Question 410.119

a. Does the design permit in-service testing of all essential components?

b. What effect does failure of the non-essential supply fan have on exhaust fan function? What is the air flow rate through the exhaust filtration unit with and without the supply fan? What is the pressure drop across the exhaust fan with and without the supply fan?

c. What is the elevation of the fresh air intakes above plant grade?

d. Is the system instrumented to monitor and alarm pressure drop and flow rates as suggested in Regulatory Position C.2 of Regulatory Guide 1.140?

e. Are fresh air intakes protected against adverse environmental conditions, high winds, rain, ice, etc?

f. Regulatory Guide 1.52 specifies placement of HEPA filters before and after carbon absorbers. Provide a justification for the use of a single HEPA filter in the proposed design.

Response 410.119

a. All essential components in the subsphere ventilation system are designed to permit in-service inspection.

b. The failure of the non-essential supply fan will have no effect on the safety function of the exhaust fan. The air flow rate through the exhaust filtration unit with the supply fan not running is 5000 CFM. It is identified in CESSAR-DC Table 9.4-2.

c. The elevation of the fresh air intakes and the grade elevation are identified in CESSAR-DC Figures 1.2-8 and 1.2-3 respectively. These are currently being revised and will be included in a future CESSAR-DC update.

d. Yes. A differential pressure indicator controller located across the charcoal adsorber modulates a damper downstream of the filter train to maintain a constant system resistance as the filters load up. This arrangement assures a constant system flow. High and low differential pressure alarms provide indication of any abnormality in flow rates.

e. Yes. Fresh air intakes are located in the control building duct shaft and are protected against adverse environmental conditions high winds, rain, snow, ice etc.

f. HEPA filters will be used before and after carbon adsorbers. The post filter reflected in the design is a HEPA filter downstream of the carbon adsorber.

This response is being incorporated into CESSAR-DC Section 9.4.5. A markup of this section is attached.

RAI 410.119

9.4.5.3 Safety Evaluation

The essential mechanical equipment room cooling systems consist of two completely redundant, independent full-capacity systems. Division I cooling system serves Division I essential mechanical equipment rooms, and Division II cooling system serves Division II essential mechanical equipment rooms. Each train is powered from independent, Class 1E power sources. (Units with chilled water cooling coils are he[illegible]ed on separate essential chilled water cooling systems.) Eq[illegible]ent capacities are selected based on conservative evaluations of heat-producing equipment and conservative assumptions of adjacent area temperatures. Failure of one train may cause subsequent loss of components in the associated rooms. The consequences of this are acceptable since full redundancy of essential mechanical components is provided.

All essential components of the mechanical equipment room cooling systems are designed as Seismic Category I equipment, and will remain functional following a design basis earthquake. Intake and exhaust structures are protected from wind-generated or tornado-generated missiles.

Redundant components of the essential mechanical equipment room cooling systems are physically separated and protected from internally generated missiles. When subjected to pipe break effects, the components are not required to operate because the served mechanical equipment is located in the same space as the cooling components. Therefore, a pipe break in the same mechanical safety train is the only possible means of affecting the cooling system. I

The Subsphere Building essential HVAC exhaust filter trains complete with particulate filters and carbon adsorbers shown in Figure 9.4-5 are designed to limit the offsite and control room dose within the guidelines of 10 CFR 100.

Inserts 1, 2 and 3.

9.4.5.4 Inspection and Testing Requirements

Performance characteristics of the Subsphere Building Ventilation System will be verified through qualification testing of components as follows:

A. Essential equipment, fans, dampers, coils, and ductwork will be tested in accordance with ASME/ANSI AG-1-1988.

B. One of each type of essential cooling fan will also be tested in accordance with AMCA.

Insert 1 Question 410.119

A differential pressure indicator controller located across the charcoal adsorber modulates a damper downstream of the filter train to maintain a constant system resistance as the filters load up. This arrangement assures a constant system flow. High and low differential pressure alarms provide indication of any abnormality in flow rates.

Insert 2

All essential components in the subsphere ventilation system are designed to permit in-service inspection.

Insert 3

Fresh air intakes are located in the control building duct shaft and are protected against adverse environmental conditions high winds, rain, snow, ice etc.

Question 410.121
(9.4.8)

a. Provide a diagram showing all system components and general configuration of the serviced areas.

b. What is the elevation above plant grade of the fresh air intakes?

Response 410.121
(9.4.8)

a. The diagram of the Station Service Water Pump Structure Ventilation System depends on the Station Service Water Pump Structure, which is site dependent. Therefore, this diagram cannot be provided in CESSAR-DC. System, component, and configuration requirements will be provided in the Station Service Water Pump Structure Ventilation System Interface Requirements which will be included in a February, 1992, submittal.

b. The Station Service Water Pump Structure is an out of scope structure. The fresh air intake elevation requirements, will be provided in the Station Service Water Pump Structure Ventilation System Interface Requirements which will be included in a February, 1992, submittal.

Question 410.122
(9.4.9)

a. What are the heat loads and system design parameters for the cooling units in the essential equipment areas served by this system?

b. Provide system diagrams showing locations, components and configuration of the nuclear annex ventilation and cooling system.

c. Does the design provide for in-service inspection of essential components?

d. Is the Nuclear Annex Building constructed to Seismic Category I standards?

e. Does essential equipment function in loss of off-site power?

f. Clarify the meaning of the reference to the Subsphere Building Ventilation System in Section 9.4.9.4.

Response 410.122
(9.4.9)

a. The heat loads and system design parameters for the essential equipment areas served by this system are provided in Table 9.4-2. A markup of Table 9.4-2 is attached to include the CCW Pump Rooms.

b. The general arrangement, Figure 1.2-8, will provide the physical locations of the major components for the nuclear annex ventilation and cooling system. The diagram F413-10 shows the nuclear annex ventilation components and configuration which is attached for NRC review. These drawings are being revised and will be provided in a future amendment of CESSAR-DC.

c. The system is designed to provide for in-service inspection of essential components.

d. The Nuclear Annex Building is designed to Seismic Category I standards as noted in CESSAR-DC Table 3.2-1 Sheet 14 of 17.

e. A loss of offsite power will not affect the safety function of essential equipment.

f. The Subsphere Building Ventilation System should be Nuclear Annex Building Ventilation System.

This response will be incorporated into CESSAR-DC Section 9.5.1 in a future amendment. A markup of this section is attached.

C. Coils are rated in accordance with ARI standards. Coils associated with the essential cooling units are tested in accordance with ASME B&PV Code, Section III, Class 3.

D. HEPA filters are manufactured and tested prior to installation in accordance with MIL-F-51068. HEPA filters will be tested in place after initial installation and periodically thereafter to verify filter integrity.

E. Ductwork is fabricated, installed, leak-tested, and balanced in accordance with SMACNA.

Initial functional testing of the Subsphere Building Ventilation System will verify fan flow rates, cooling water flow distribution, and operation of interlocks and controls.

The safety-related recirculation systems will be tested by initiating the system. Fan performance, proper cooling water flow, cooling coil performance, and system response time will be tested initially and periodically during the plant operating life. Insert 1

9.4.9.5 Instrumentation Application

Instrumentation is provided to provide automatic or manual operation of the system, both from local and/or remote locations and permit verification that the system is operating satisfactorily. I

Indication of the fan operating status is provided in the control room. Failure of a running fan is alarmed in the control room.

Indication of damper positions/damper alignment is provided in the control room.

Indication of pressure drop across filters (supply filters and exhaust filter trains) is provided locally.

Temperature indication for the essential mechanical equipment rooms is provided in the control room.

The following data shall be available to determine system performance:

A. Entering and leaving air temperature for the supply ventilation unit.

Q 410.122

Attachment ALWR-346

TABLE 9.4-2 (Cont'd)

(Sheet 12 of 12)

HVAC SYSTEM DESIGN PARAMETERS

Area or Location	Operational Mode		Type System	Heat Load Btu/hr	Flow Rate/Unit		No Units % Capacity	Power Supply	Equipment
	Normal	Essential			Air CFM	Cool Water gpm			
Control Bldg. Toilet	X	-	Exhaust	-	3,000	-	1/100	120/460	Roof Exh. Fan, 1 HP
Battery Rm. I	X	-	Ventilate	-	700	-	1/100	120/460	Fan, 1 HP
Battery Rm. II	X	-	Ventilate	-	700	-	1/100	120/460	Fan, 1 HP
Diesel Rm. I	-	X	Ventilate	-	50,000	-	2/50	460	Fan, 30 HP
Diesel Rm. II	-	X	Ventilate	-	50,000	-	2/50	460	Fan, 30 HP
CCW Pump Rm. IA	-	X	Recirculating AHU	250,000	5,000	45	1/100	120/460 3BHP	Cooling Coil, Fan, Filter
CCW Pump Rm. IB	-	X	Recirculating AHU	250,000	5,000	45	1/100	120/460 3BHP	Cooling Coil, Fan, Filter
CCW Pump Rm. IIA	-	X	Recirculating AHU	250,000	5,000	45	1/100	120/460 3BHP	Cooling Coil, Fan, Filter
CCW Pump Rm. IIB	-	X	Recirculating AHU	250,000	5,000	45	1/100	120/460 3BHP	Cooling Coil, Fan, Filter

I

Question 410.123

With regard to the recommendations of NUREG/CR-0660, additional information is needed to address the following concerns.

1. For the control of dust in the diesel generator building provide assurance that instruments will be mounted in dust tight enclosures and those requiring ventilation will be provided with filtered louvers and gasketed doors, air for building ventilation is taken through an intake at least 20 feet above ground, and measures will be taken to paint exposed concrete floors.

2. All instruments not required to be mounted on the engine itself are required to be mounted on a free standing floor mounted cabinet to limit the effects of vibration due to diesel engine operation. Verify that the instrument panels discussed in Chapters 8 and 9 of the SSAR meet this requirement.

3. The following should be addressed as an interface requirement: personnel training for diesel generator operation including manufacturer recommended surveillance testing, preventative maintenance and root cause analysis all of which should be incorporated into the diesel generator operation.

Response 410.123

1. CESSAR-DC Sections 9.4.4 and 9.5.8 will be revised to state that the diesel building fresh air intake is located 20 feet above grade to minimize the intake of dust. The diesel generator building fresh air intake structure will be modified to meet this requirement. Section 9.4.4 will also include a requirement for painting all exposed diesel generator building interior surfaces for dust control. Marked-up copies of these sections are included.

   By providing 20 feet clearance above grade for the diesel building fresh air intake, sealed electrical cabinets are not required in accordance with Section 9.4.5 of the Standard Review Plan. Dust control requirements given in Section 8.3.1 of the Standard Review Plan for instrumentation required to start the diesel generator are also met with this design.

2. As stated in CESSAR-DC Section 8.3.1.1.4, the emergency diesel generator controls and monitoring instrumentation, with the exception of the sensors and other equipment that must necessarily be mounted on the diesel generator or its associated piping, are installed in free standing floor mounted panels which are designed for their normal vibratio environment and qualified to Seismic Category I requirements

When the diesel generator is shut down, the ventilation system can be manually activated if necessary to provide cooling for maintenance or testing access. A low room temperature setpoint will shut down all fans in order to limit the minimum room temperature to 40°F and prevent freezing. Unit heaters will be installed to hold the room temperature above 40°F. E I

A missile barrier is provided over each air intake and exhaust louver to prevent the penetration of a missile into either diesel generator building. Intake and exhaust ducts are protected by appropriate security barriers.

9.4.4.3 Safety Evaluation

Each Diesel Building Ventilation System automatically maintains a suitable environment in each diesel enclosure under all operating conditions. E

Each diesel generator building ventilation system has sufficient cooling capacity to maintain the diesel room at 120°F or below with the diesel operating at rated load and with ambient outside design air temperature as shown in Table 9.4-1.

Unit heaters are cycled as necessary to maintain a minimum temperature of 40°F for freeze prevention. Heat losses from equipment are conservatively estimated based on calculations and operating experience. I

A single failure will not prevent the diesel generator building ventilation system from performing the intended heat removal function. Each ventilation train is powered by a Class 1E electrical system capable of being fed from the associated diesel generator.

Essential components of the diesel generator building ventilations system are designed to Seismic Category I requirements and will remain functional following a safe shutdown earthquake. E

Diesel generator ventilation trains are located in separate buildings above the respective diesel generators. Each penetration into the building is provided with protection from external missiles. No high or moderate energy piping is located in the vicinity of the ventilation equipment or controls.

Insert 1 →

9.4.4.4 Inspection and Testing Requirements

Performance characteristics of the diesel building ventilation system are verified through the following qualification testing of essential components:

Question 410.123

With regard to the recommendations of NUREG/CR-0660, additional information is needed to address the following concerns.

1. For the control of dust in the diesel generator building provide assurance that instruments will be mounted in dust tight enclosures and those requiring ventilation will be provided with filtered louvers and gasketed doors, air for building ventilation is taken through an intake at least 20 feet above ground, and measures will be taken to paint exposed concrete floors.

2. All instruments not required to be mounted on the engine itself are required to be mounted on a free standing floor mounted cabinet to limit the effects of vibration due to diesel engine operation. Verify that the instrument panels discussed in Chapters 8 and 9 of the SSAR meet this requirement.

3. The following should be addressed as an interface requirement: personnel training for diesel generator operation including manufacturer recommended surveillance testing, preventative maintenance and root cause analysis all of which should be incorporated into the diesel generator operation.

Response 410.123

1. CESSAR-DC Sections 9.4.4 and 9.5.8 will be revised to state that the diesel building fresh air intake is located 20 feet above grade to minimize the intake of dust. The diesel generator building fresh air intake structure will be modified to meet this requirement. Section 9.4.4 will also include a requirement for painting all exposed diesel generator building interior surfaces for dust control. Marked-up copies of these sections are included.

   By providing 20 feet clearance above grade for the diesel building fresh air intake, sealed electrical cabinets are not required in accordance with Section 9.4.5 of the Standard Review Plan. Dust control requirements given in Section 8.3.1 of the Standard Review Plan for instrumentation required to start the diesel generator are also met with this design.

2. As stated in CESSAR-DC Section 8.3.1.1.4, the emergency diesel generator controls and monitoring instrumentation, with the exception of the sensors and other equipment that must necessarily be mounted on the diesel generator or its associated piping, are installed in free standing floor mounted panels which are designed for their normal vibration environment and qualified to Seismic Category I requirements.

3. Section 8.3.1.1.4 will be revised to include operational requirements for training of personnel and the establishment of a preventive maintenance program. A marked-up copy of the revised section is included for NRC review.

CESSAR-DC Attachment (Refer to page 9.4-20)

INSERT 1:

The fresh air intake for the Diesel Generator Building Ventilation System is located 20 feet above grade to minimize the intake of dust into the building. All exposed diesel generator building interior surfaces are painted to aid in dust control.

The aftercooler removes heat from the compressed intake air, decreasing the air temperature. Cooling water flows through the tube side and its temperature increases. E

There are no active components in the air intake and exhaust system. I

9.5.8.3 Safety Evaluation

The Diesel Generator Engine Air Intake and Exhaust System is an ANSI Class 3 piping system. The diesel engine and engine mounted components are constructed in accordance with IEEE Standard 387. The off engine essential components are designed in accordance with the requirements of the applicable codes. The intake filter, intake silencer, and exhaust silencer are ASME Section III Class 3 code approved. These components are seismically qualified by shaker table tests or analysis performed by the manufacturer. The components are installed in the diesel generator building with Seismic Category I restraints. E

The intake air plenum and the exhaust gas plenum for each diesel generator unit are at opposite ends of the diesel generator building. This fact and site-specific analysis of the diesel generator engine exhaust will establish that the rise of exhaust gases is sufficient to preclude the possibility of recirculation to the point that system integrity is jeopardized. I Normal ventilation flowrate is 5% of the diesel run mode ventilation flowrate. Normal ventilation is filtered to maintain engine room cleanliness. All diesel generator building interior surfaces are painted to minimize concrete dust. Diesel intake air is taken at a height of 10 feet above grade to minimize the intake of dust. E

Primary fire protection is provided by an automatic carbon dioxide system. The system is activated by temperature detectors which alarm and annunciate in the control room.

Onsite storage of gases is discussed in Section 9.5.10. These gases are stored at a distance from the diesel generator building such that there is no threat to the proper operation of the diesel engines. I

9.5.8.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by appropriate codes. Inspection and functional testing are performed prior to initial operation. E

9.5.8.5 Instrumentation Application

Each diesel generator engine unit is provided with sufficient instrumentation and alarms to monitor the combustion intake and

6. Regulatory Guide 1.137, Section C.1.c.

7. ANSI N195, 1976, Section 6.1. E

These preoperational tests conform with the provisions of Regulatory Guide 1.108, C.2.a and C.2.b regarding tests to be performed on emergency diesel generators. I

B. Periodic Testing E

Periodic testing of the emergency diesel generator meets the intent of Regulatory Guide 1.108 and NRC Generic Letter 84-15. I E

The emergency diesel generator is removed from service in accordance with approved procedures. Any maintenance work on the diesels is performed and inspected by qualified personnel in accordance with approved procedures. Upon completion of maintenance work, appropriate tests are completed to assure operability of the diesel generator. Upon completion of testing, appropriate operating procedures restore the diesels to standby readiness. I E

8.3.1.1.4.12 125V DC Emergency Diesel Control Power I

125V DC control power for each emergency diesel generator is provided by the Class 1E 125V DC power system batteries as described in Section 8.3.2.1.2. E

Insert 2

8.3.1.1.5 Non-Class 1E Alternate AC Source Standby Power Supply

The Alternate AC Source (AAC) is a non-safety gas turbine power source provided to cope with Loss of Offsite Power (LOOP) and Station Blackout (SBO) scenarios. This standby unit is independent and diverse from the Class 1E standby emergency diesel generators. I E

The AAC is sized with sufficient capacity to accommodate either of the following load configurations:

A. Both sets of X and Y Permanent Non-safety loads; or

B. One set of Permanent Non-Safety loads and one set of a Safety Division's loads as indicated below:

1. Permanent Non-Safety X with Division I only, or,

2. Permanent Non-Safety Y with Division II only.

CESSAR-DC Attachment (Refer to page 8.3-12)

INSERT 2:

8.3.1.1.4.13 Operational Requirements

The applicant shall provide a complete training program for all mechanical and electrical maintenance, quality control, and operating personnel, including supervisors who are responsible for maintenance and availability of the diesel generators. The depth and quality of training shall be at least equivalent to that provided by the diesel generator manufacturer.

The applicant shall establish a preventive maintenance program which encompasses investigative testing of components which have a history of repeated repair and replacement of those components with other products of proven reliability.

Question 410.124

a. Section 9.5.4.3 alternately states that "buried piping and tanks are protected..by an impressed current cathodic protection system" and "impressed current cathodic protection (if provided) system surveillances." Clarify whether such a system is part of the diesel generator engine fuel oil system design.

b. Section 9.5.4.2.1 states that the four fuel oil tanks are "centrally located and integrally connected with normally closed isolation valves." This statement is interpreted to mean that the storage tanks which are not identified in the plant layout diagrams are in close proximity to each other which could violate separation criteria for redundant systems. Provide justification for the apparent lack of separation. Additionally, the location of the fuel oil recirculation system is not identified. Is this system, and the associated safety grade isolation valves, located above ground, below ground, or housed within a structure? Identify the means provided to protect the safety related interfaces from natural phenomena.

c. Provide justification for the lack of flame arrestors on the fuel oil storage and day tanks as required by ANSI standard N195.

d. No temperature indications or controls appear to be provided for the fuel oil system. Therefore, provide an interface requirement that will ensure that the fuel oil cloud point is lower than the 3 hour minimum soak temperature to insure ignition as required in Reg Guide 1.137.

e. Figure 9.5.4-1 shows provisions for drains in the fuel oil day tank but the text does not discuss the means to control water accumulation in the day tank. Provide a discussion of the control of water in the fuel oil day tank that addresses the recommendations of NUREG/CR-0660.

Response 410.124

a. Buried components in the diesel generator fuel oil system are provided with a corrosion protection system. However, the impressed current cathodic protection system is only a recommendation for such protection of external surfaces of buried equipment. The corrosion protection system utilized in the design of the diesel generator fuel oil system will be based on site specific conditions.

   Section 9.5.4.3 of CESSAR-DC will be revised to clarify that the impressed current cathodic protection system is only a recommended means of corrosion protection for the external surfaces of buried equipment. A marked-up copy of Section 9.5.4.3 is attached.

b. Each diesel generator is provided with two half capacity fuel oil storage tanks. Each set of storage tanks is provided with a fuel oil recirculation system. Each set of storage tanks and the associated recirculation system is located within a Seismic Category I structure and meets separation criteria for redundant systems.

Section 9.5.4.1, Section 9.5.4.2.1, and sheets 1 and 2 of Figure 9.5.4.1 of CESSAR-DC will be revised to reflect the separation and location of redundant fuel oil storage components. A marked up copy of these revisions is attached.

c. Flame arresters are not provided on the fuel oil storage tank vents or on the day tank vents. Based on Section 30 and 37 of the NFPA fire codes, No. 2 diesel fuel oil is a Class II combustible liquid (minimum flash point 125°F) which does not require installation of flame arresters for either buried tanks or tanks installed inside of buildings.

d. All fuel oil equipment is located in heated buildings (diesel generator building or diesel fuel storage structure) and buried piping is installed below the frost line. Section 9.5.4.3 of CESSAR-DC will be revised to provide assurance that the fuel oil is maintained at a temperature above the fuel oil cloud point. A marked-up copy of Section 9.5.4.3 is attached.

An interface requirement will also be included in a future amendment of CESSAR-DC for the Diesel Fuel Storage Structure to verify that adequate heating is provided to ensure this requirement is met.

e. Section 16.11.3 of CESSAR-DC requires the fuel oil in the day tank to be sampled for water content every 31 days. Any accumulated water is drained from the tank through the drain connection provided on the bottom of the tank.

Section 9.5.4 of CESSAR-DC will be revised to include this response. A marked-up copy of Section 9.5.4 is attached.

9.5.4 DIESEL GENERATOR ENGINE FUEL OIL SYSTEM

9.5.4.1 Design Bases

E

The Diesel Generator Engine Fuel Oil System is designed to provide for storage of a seven-day supply of fuel oil for each diesel generator engine and to supply the fuel oil to the engine, as necessary, to drive the emergency generator. The system is designed to meet the single failure criterion, and to withstand the effects of natural phenomena without the loss of operability.

diesel fuel storage structure

All components and piping are located in a Seismic Category I structure (diesel generator building) except for ~~the fuel oil storage tanks and~~ a portion of the piping from the fuel oil storage tanks to the day tank, which is seismically qualified and protected. All essential components and piping are fully protected from floods, tornado missile damage, internal missiles, pipe breaks and whip, jet impingement and interaction with non-seismic systems in the vicinity. I

9.5.4.2 System Description

The Diesel Generator Engine Fuel Oil System is shown in Figure 9.5.4-1 (Sheets 1 and 2).

9.5.4.2.1 General

A separate and complete fuel oil storage and transfer system is provided for each diesel generator engine. Two ~~underground~~ storage tanks provide fuel oil for each engine, which is sufficient to operate at full load for a period of time no less than seven days plus a margin to allow periodic testing. E

Typically, this requires a combined usable volume of 135,000 gallons. The site-specific SAR shall verify that this is adequate for the diesel generators purchased.

Fuel oil is transferred by the fuel oil transfer pump from the storage tanks to the day tank which is located within retaining walls inside the diesel generator building. The fuel oil transfer pump is also located in the diesel generator building and is typically sized for 75 gpm. The day tank has a sufficient capacity of fuel oil to operate the diesel generator engine in excess of 60 minutes at full load. Typically, this requires a day tank of 900 gallons. The site-specific SAR shall verify that fuel oil transfer pump flow and day tank capacity are adequate for the diesel generators purchased. I

ADD INSERT 1

To prevent settling, stratification and deterioration of the fuel oil during extended periods, a system is provided to recirculate or transfer filtered fuel oil. Four fuel oil tanks (two half capacity storage tanks per redundant diesel) are centrally located and integrally connected with normally closed isolation valves and check valves to prevent backfilling and possible contamination of fuel oil between tanks. A manually operated, positive displacement recirculation pump takes suction from the flush mounted sample connection on the bottom of the storage tank and discharges the fuel oil through a simplex filter with alternate bypass line to the storage tank fill connection. The filtering and recirculation process is performed on a tank by tank basis with the frequency of operation dependent on the results of a fuel oil inspection program. Since two half capacity storage tanks are provided per diesel, one tank will be aligned to supply fuel oil to its respective diesel while isolating the second tank through administrative control. The contents of the isolated storage tank would be filtered and recirculated. Prior to realigning the tank to its respective diesel, a period of not less than 24 hours is required to allow any stirred sediment to settle. E

Should the recirculation system be operating in the event of a LOCA, a redundant, safety related interlock is provided to shutdown the recirculation pump to prevent possible stirring of sediment. A redundant safety-related interlock is also provided to shutdown the recirculation pump should the fuel oil in the storage tanks drop below a level to preclude loss of fuel oil in the event of a recirculation system pipe rupture.

These two safety-related and redundant interlocks protect the Diesel Generator Fuel Oil System during operation of the recirculation system. They assure uninterrupted operation of the essential emergency diesels in the event of a Loss of Offsite Power or LOCA.

Fuel oil amenders are added as necessary to extend oil life by preventing oxidation and stratification. A sample is used to inspect the oil for water content or degradation and if degradation is determined, the oil may be pumped out for disposal. Accumulated water in the fuel oil storage tanks will be removed by the recirculation system through a sample connection provided on the recirculation pump discharge.

The day tank vent and fuel oil storage tank vents and fill connections which are exposed outdoors, are protected from tornado missiles through the construction of the vents using heavy gauge pipe and are located above the probable maximum flood level. Each fill connection is provided with a locking dust cap 1

CESSAR-DC Attachment (Refer to page 9.5-53)

INSERT 1:

To prevent settling, stratification, and deterioration of the fuel oil during extended periods, a system is provided to recirculate or transfer filtered fuel oil. A separate and complete recirculation system is provided for each set of half capacity fuel oil storage tanks. Each set of storage tanks shall be integrally connected with normally closed isolation valves and check valves to prevent backfilling and possible contamination of the fuel oil between tanks. A manually operated positive displacement pump provided for each set of storage tanks takes suction from the flush mounted sample connection on the bottom of the storage tank and discharges the fuel oil through a simplex filter with alternate bypass line to the storage tank fill connection.

CESSAR-DC Attachment (Refer to page 9.5-51)

INSERT 2:

Fuel oil stored in the day tank is periodically checked for water content. Any accumulated water is drained from the tank through the drain connection provided on the bottom of the tank.

and each vent line is down turned. The storage tanks can be filled and vented through the manway should the fill or vent lines become impaired.

9.5.4.2.2 Component Description

Fuel is recirculated within the storage facility to prevent deterioration by a recirculation pump.

The motor-driven fuel oil booster pump is normally isolated, both electrically and mechanically, but may be operated if required during maintenance to deliver fuel oil to the diesel. E

9.5.4.3 Safety Evaluation

The Diesel Generator Engine Fuel Oil System is a ANSI Class 3 piping system with the exception of the Fuel Oil Recirculation System and the fuel oil storage tank fill line strainer which are ANSI Class 4 piping systems. The Fuel Oil Recirculation System and the fuel oil storage tank fill line strainer are separated from the essential Diesel Generator Fuel Oil System by normally closed ANSI Class 3 isolation valves. An ANSI Class 4 flexible rubber hose is used to connect the ANSI Class 4 fill line strainer to the ANSI Class 3 fuel oil storage tank fill lines. The diesel engine and engine mounted components are constructed in accordance with IEEE Standard 387. The fuel oil system is designed and constructed in compliance with ANSI Standard N195, except in regards to the flame arresters on the storage tanks. I

Each diesel generator unit is housed separately in a Seismic Category I structure.

Diesel fuel oil 2D, as specified by ASTM D975, is normally delivered to the site by private carriers. The fuel oil storage capacity is based on continuous operation of the diesel generator engines at rated load for a period of seven days. A 10 percent margin in storage capacity is provided to preclude the necessity of refilling the tanks following routine performance testing. The exterior of carbon steel tanks and other underground carbon steel components is coated. In addition to being coated, the external surfaces of buried metallic piping and tanks are protected from corrosion by an impressed current cathodic protection system in accordance with NACE Standard RP-01-69 or other me[illegible] as deemed appropriate [illegible] site specific conditions. E
The interior of the fuel oil storage tanks are not coated since the presence of fuel oil will act as a deterrent to internal corrosion. Requirements assure that the fuel oil storage tanks are maintained essentially full to provide a seven day supply.

During surveillance intervals for sampling the fuel oil in the storage tanks, any accumulated water or sediment detected will be removed via the Fuel Oil Recirculation System. The fuel oil storage tanks are set at a level above the normal ground water table. E

The fuel oil sampling and impressed current cathodic protection (if provided) system surveillances are in conformance with guidance of Regulatory Guide 1.137, Position C.2. I

During normal operation of the diesel any accumulated sediment in the bottom of the fuel oil storage tanks is prevented from entering the supply line to the day tank since the outlet connection is raised 6 inches above the storage tank floor. During the addition of new fuel oil, degradation or failure of the diesel generator engine due to stirring of sediments is prevented by a two tank system. Two half capacity fuel oil storage tanks per redundant diesel provide the ability to operate the diesel off one tank while isolating and filling the adjacent tank. Prior to the addition of new fuel oil either during an accident or when "topping off" the fuel oil storage tank, the diesel would be aligned to one tank while the tank to be filled would be isolated through administrative control. After filling the storage tank, a period of not less than 24 hours must be allotted to allow sediment to settle prior to realigning the tank to its respective diesel. In the event of an accident (blackout or LOCA), a sufficient reserve of fuel oil will be maintained to allow the diesel to operate off one storage tank while refilling the adjacent fuel oil storage tank, allowing for a 24 hour settling period. E

To minimize the chances of a fire in the fuel oil system, piping is routed such that it is remote from other piping and equipment with potentially hot surfaces and from any source of open flame or sparks. The fuel oil day tank is protected by a fire barrier.

There are no high energy lines within the diesel generator building and all moderate energy lines are properly supported and restrained to prevent damage to safety-related systems, piping and components resulting from line failure.

9.5.4.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by appropriate codes. Inspection and functional testing are performed prior to initial operation.

[illegible] equipment is located in heated buildings except buried [illegible] which is installed below the frost line to maintain the [illegible]

Question 410.125

a. The diesel generator is required to be able to operate for extended periods with less than full electrical power generation required without degradation of performance or reliability. Provide an interface requirement that will ensure that procedures to prevent excessive light load operation will be developed. As an example, a requirement that the diesel will be operated at 25% load for 1 hour after 8 hours of continuous light load operation or as per manufacturers recommendations is sufficient.

b. A three way thermostatic control valve regulates flow through the shell side of the jacket water cooler. Verify that this valve will be of the Amot type or equivalent as recommended by NUREG/CR-0660.

Response 410.125

a. This requirement is addressed in the response to NRC RAI 430.27.

b. Section 9.5.5 of CESSAR-DC will be revised to state that the three-way thermostatic control valve is an Amot type or equivalent. A marked-up copy is attached.

9.5.5 DIESEL GENERATOR ENGINE COOLING WATER SYSTEM

9.5.5.1 Design Bases

The Diesel Generator Engine Cooling Water System is designed to maintain the temperature of the diesel generator engine within an optimum operating range during standby and during full-load operation in order to assure its fast starting and load-accepting capabilit and to reduce thermal stresses. The system is also designed to supply cooling water to the engine lube oil cooler, the combustion air aftercoolers, and the governor lube oil cooler. E

All components and piping are located within a Seismic Category I structure (diesel generator building) and all essential components are fully protected from floods, tornado missile damage, internal missiles, pipe breaks and whip, jet impingement and interaction with non-seismic systems in the vicinity. I

9.5.5.2 System Description

The Diesel Generator Engine Cooling Water System is shown in Figure 9.5.5-1.

9.5.5.2.1 General

A separate and complete closed-loop cooling water system is provided for each diesel generator engine, receiving makeup water from the Demineralized Water System and uses as it's sink the Component Cooling Water System. A surge tank, the jacket water standpipe located in the diesel generator building, provides positive suction pressure for the circulation pump and for the keep warm pump. The keep warm pump, which is electric motor-driven, operates continuously during engine standby to assure that the system is completely filled with water. When the diesel starts, the circulation pump, which is engine mounted and engine-driven, would operate to circulate cooling water through the closed loop system. E

From the circulation pump, the cooling water passes through an three-way thermostatic control valve which regulates the flow of water through the shell side of the jacket water cooler by diverting varying amounts through a bypass line. From the jacket water cooler, the cooling water flows through the tube side of either the lube oil cooler or the combustion air aftercoolers and then through the engine itself, returning to the standpipe. A small fraction of the flow from the discharge side of the combustion air aftercooler is diverted to the engine governor lube oil cooler.

Question 410.126

Verify that the air dryers of the diesel generator engine starting air system will be capable of supplying air with a dew point of not more than 50°F for a normally controlled 70°F environment or dewpoint at least 10°F lower than the lowest expected ambient temperature.

Response 410.126

The diesel generator starting air system is located in the diesel generator building which is maintained at a temperature between 40°F and 120°F. Regenerative desiccant type dryers, which are the type pr[illegible]ded in the starting air system, are capable of deliver[illegible]pressed air with dew points well below 0°F. CESSAR-[illegible].5.[illegible] will be revised to state that air is suppli[illegible] poi[illegible] at least 10°F lower than the lowest expect[illegible]emperature by the diesel generator engine sta[illegible]m. A marked-up copy of Section 9.5.6.2.2 is [illegible]

The starting air receiver tanks also supply air at reduced pressure to the engine control panel instrumentation. Air enters the engine control panel where it is filtered and a self-contained pressure regulator maintains constant pressure for the diesel automatic safety shutdown system. The automatic safety shutdown system is made up of a network of vent on fault pneumatic devices which monitor the engines parameters, tripping the engine when a manufacture's recommended temperature, pressure, overspeed, or vibration setpoint has been exceeded. There are two types of engine trips. Group "A" trips are active only during the periodic testing of the diesel to prevent damage to the engine and are locked out during the emergency mode (i.e., LOOP or LOCA) allowing the engine to continue to run. Group "A" trips include and are activated upon: low lube oil pressure, low left and right turbocharger oil pressure, high crankcase pressure, excessive engine vibration, high lube oil temperature, high temperature main bearings, and high-high jacket water temperature. Group "B" trips remain active during the emergency mode to shutdown the engine should a setpoint be exceeded. Group "B" trips include and are activated upon; engine overspeed, low-low lube oil pressure, and generator differential. The low-low lube oil pressure trip contains redundant (two out of three) logic which must be affected to activate a diesel shutdown. The pneumatic logic for Group "A" and "B" trips consumes negligible volume, operating on pressure rather than flow capacity. Sufficient air pressure remains available for operating the pneumatic logic following five successive start attempts. In addition, the starting air compressors, air dryers, aftercoolers, piping and valves are Seismic Category I, seismically qualified to remain operable following a design basis earthquake. The starting air compressors and air dryers receive Class 1E power from their associated diesel. E

Relief valves on the compressor discharge line and on the air receiver tanks protect the starting air system from overpressurization.

9.5.6.2.2 Component Description

The starting air compressors are driven by electric motors which are powered from the Essential Auxiliary Power Supply. Each compressor discharges compressed air and the heat of compression is removed by a water-cooled aftercooler. The component cooling water system provides cooling water on the tube side.

To minimize the accumulation of moisture, the diesel engine starting air system is equipped with a multi-stage drying and filtering unit located in line between the aftercooler and the receiver tank* The air is first thrown through a cyclone-type

*to supply air with a dewpoint at least 10°F lower than the lowest expected ambient temperature.

Question 410.127

The lube oil system includes a continuously operating prelube pump. Figure 9.5.7-1 shows local indication of pump discharge pressure and differential pressure across the prelube oil filter. However, no alarms are provided, as required, to alert operator of prelube pump failures. Either provide a means to alarm pump failure or verify that the system low pressure alarms will actuate a diesel generator trouble signal in the control room when the diesel is in the standby mode, as well as during generator operation, and the prelube pump fails.

Response 410.127

Instrumentation is provided to alarm low prelube oil pressure during diesel generator standby. The alarm is not required to be active while the diesel generator is in operation since the prelube oil system performs no function with the diesel running.

Section 9.5.7.5 of CESSAR-DC will be revised to state that an alarm is provided to alert the operator of failure of the diesel generator prelube oil system while the diesel is in standby. A marked-up copy of Section 9.5.7.5 is attached.

9.5.7.5 Instrumentation Application

Each diesel generator engine is provided with sufficient instrumentation and alarms to monitor the operation of the lube oil system. All alarms are separately annunciated on the local diesel engine control panel which also signals a general diesel trouble alarm in the control room. The lube oil system is provided with the following instrumentation and alarms:

The lube oil sump tank is equipped with a local level indicator along with a low level annunciator to alert the operator to take corrective action.

The full flow filters are equipped with locally-mounted pressure gauges. A high differential pressure alarm alerts the operator to manually switchover to the alternate clean filter; there is no bypass.

The engine mounted full flow strainers are equipped with a high differential pressure alarm which alerts the operator to manually switchover to the alternate clean strainer; there is no bypass.

The diesel generator engine is equipped with both temperature and pressure monitoring systems with separate alarm and trip switches to alert the operator of abnormal operating conditions. If a shutdown setpoint/alarm is exceeded while the engine is operating during the test mode, a diesel trip will automatically shutdown the engine to prevent incurring any damage. ADD INSERT 1 E

However, if such a shutdown/alarm is received during the emergency mode (i.e., LOOP or LOCA) the trip is locked out and the engine continues to run. The alarms alert the operator to prepare to switch over to the redundant diesel for power. Only a low-low engine lube oil pressure shutdown/alarm will trip the engine regardless of the diesel operating mode.

The engine inlet and outlet lube oil temperatures are also recorded by a multipoint recorder and may be monitored by a multi-channel pyrometer (in manual mode). Both the recorder and pyrometer are located on the generator control panel in the diesel generator building.

The periodic testing and maintenance of all diesel engine lube oil system instruments is controlled by a preventative maintenance program. This program insures that instruments are periodically calibrated and tested, assuring reliability.

CESSAR-DC Attachment (Refer to page 9.5-71)

INSERT 1:

During standby, low prelube oil pressure is alarmed to alert operating personnel to take corrective action.

Question 410.128

The recommended height for the intake of the Diesel generator engine intake and exhaust system is 20 feet from ground level to the bottom of the intake. Section 9.5.8.3 states that the diesel intake air is taken at a height of 10 feet above grade. Either provide justification for not placing the air intake as recommended in NUREG/CR-0660 and SRP Section 9.5.8 or modify the design to meet the recommendations.

Response 410.128

The bottom of the diesel generator air intake opening is located 20 feet above grade in accordance with SRP Section 9.5.8. A marked-up copy of CESSAR-DC Section 9.5.8.3 is attached.

The aftercooler removes heat from the compressed intake air, decreasing the air temperature. Cooling water flows through the tube side and its temperature increases. E

There are no active components in the air intake and exhaust system. I

9.5.8.3 Safety Evaluation

The Diesel Generator Engine Air Intake and Exhaust System is an ANSI Class 3 piping system. The diesel engine and engine mounted components are constructed in accordance with IEEE Standard 387. The off engine essential components are designed in accordance with the requirements of the applicable codes. The intake filter, intake silencer, and exhaust silencer are ASME Section III Class 3 code approved. These components are seismically qualified by shaker table tests or analysis performed by the manufacturer. The components are installed in the diesel generator building with Seismic Category I restraints. E

The intake air plenum and the exhaust gas plenum for each diesel generator unit are at opposite ends of the diesel generator building. This fact and site-specific analysis of the diesel generator engine exhaust will establish that the rise of exhaust gases is sufficient to preclude the possibility of recirculation to the point that system integrity is jeopardized. I Normal ventilation flowrate is 5% of the diesel run mode ventilation flowrate. Normal ventilation is filtered to maintain engine room cleanliness. All diesel generator building interior surfaces are painted to minimize concrete dust. Diesel intake air is taken at a height of ~~10~~ 20 feet above grade to minimize the intake of dust. E

Primary fire protection is provided by an automatic carbon dioxide system. The system is activated by temperature detectors which alarm and annunciate in the control room.

Onsite storage of gases is discussed in Section 9.5.10. These gases are stored at a distance from the diesel generator building such that there is no threat to the proper operation of the diesel engines. I

9.5.8.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by appropriate codes. Inspection and functional testing are performed prior to initial operation. E

9.5.8.5 Instrumentation Application

Each diesel generator engine unit is provided with sufficient instrumentation and alarms to monitor the combustion intake and

Question 410.129

a. It is unclear where the Diesel Generator Sump Pump System connects to the Equipment and Floor Drainage System. Provide information identifying the connection between the systems.

b. Since the pumps in the system are required for flood protection for the diesel generators, the instrumentation required for pump operation should also be safety related. Provide verification that the instrumentation for the sump pumps are of the appropriate safety class and seismically qualified.

Response 410.129

a. The Diesel Generator Sump Pump System connects to the Nuclear Annex Nonradioactive Floor Drain System upstream of the system's radiation monitors. A P&ID will be provided for the Diesel Generator Sump Pump System (Figure 9.5.9-1) and Figure 9.3.3-4 will be revised to include the connection between the two systems. These revisions will be included in a future amendment to the System 80+™ CESSAR-DC.

b. The instrumentation required for the operation of the Diesel Generator Sump Pump System is safety-related as are the sump pumps. CESSAR-DC Section 9.5.9 will be revised to indicate the instrumentation is safety-related and seismically qualified. These revisions will be included in a future amendment to the System 80+™ CESSAR-DC.

The Diesel Generator Building Sump Pump System flow diagram is shown in Figure 9.5.9-1.

9.5.9 DIESEL GENERATOR BUILDING SUMP PUMP SYSTEM

9.5.9.1 Design Bases

The Diesel Generator Building Sump Pump System is designed to remove leakage and equipment drainage from the diesel generator building and to protect the diesel generator units from internal flooding caused by the maximum credible pipe rupture in the Diesel Generator Building.

All components and piping are located within a Seismic Category I structure (diesel generator building) and all essential components are fully protected from floods, tornado missile damage, internal missiles, pipe breaks and whip, jet impingement and interaction with non-seismic systems in the vicinity.

9.5.9.2 System Description

Two sump pumps are provided in each diesel generator building. The pumps are located in the pit below the lube oil sump tank.

The sump pumps start automatically on high sump water level and transfer the water to the equipment and floor drain system.

The diesel generator building sumps and sump pumps are designed for a constant inflow rate of 75 gpm with a maximum pump cycle time of three starts per hour (one pump operating with 37.5 gpm inflow). The maximum pumping flowrate with both pumps operating is 150 gpm. The site-specific SAR shall verify that this is adequate for the maximum leakage or maximum credible pipe rupture located in the diesel generator building.

9.5.9.3 Safety Evaluation

The Diesel Generator Building Sump Pump System is an ANSI Class 3 piping system and the pumps and system components are designed in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section III, Class 3.

9.5.9.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by appropriate codes. Inspection and functional testing are performed prior to initial operation; thereafter, equipment not in continuous use is subject to periodic testing and visual inspection.

Instrumentation associated with sump pump operation is Safety Class 3 and Seismic Category I.
The sump pumps are also powered from the diesel generators in the event of [illegible] power.

Question 410.130 (10.2)

a. Provide a system piping and instrumentation diagram (P&ID) which shows the general arrangement of the turbine generator system (TGS) and associated equipment with respect to safety-related structures, systems and components. This should include the relative location of major components, instruments and valves (i.e., main steam stop and control valves, reheat stop and intercept valves, extraction steam valving).

b. Provide information confirming that the extraction check valves will be capable of closing within the time limits required to maintain stable conditions following a TGS trip.

c. Provide information which verifies that the main steam stop, control, reheat stop and intercept valve closure times are within the required limits.

d. Provide a description of TGS speed-load control during normal operation. Verify that the speed governor action of the electro-hydraulic control system fully cuts off steam at approximately 103% of rated turbine speed by closing the control and intercept valves.

e. Verify if there are safety-related systems or components located in the turbine building or close to the TGS. Verify that the physical layout of the TGS provides protection to these components/systems from the effects of high or moderate energy piping failures.

Response 410.130

a. The typical site plan arrangement is provided in CESSAR-DC, Figure 1.2-1, which shows the required turbine orientation. The turbine missile path is also shown, which does not interact with any safety-related structures, systems or components.

   A flow diagram showing the relative location of the major components is provided in Figure 10.3.2-1 of CESSAR-DC. The detail associated with "P&IDs" is not provided since the turbine generator system (TGS) and extraction steam (ES) system are non-safety related and are located in the Turbine Building, which contains no safety-related structures, systems or components.

b. Section 10.2.2 of CESSAR-DC will be revised to include the extraction steam non-return check valve closure time criteria.

Response 410.130 (Cont'd)

c. Section 10.2.2 of CESSAR-DC will be revised to include the closure time criteria for the turbine valves (main steam stop, control, reheat stop and intercept valves) for turbine overspeed protection.

d. Section 10.2.2 of CESSAR-DC will be revised to include the criteria that the speed governor for normal speed-load control fully closes the control and intercept valves at 105% of turbine normal operating speed.

e. As stated in Section 10.2.3 of CESSAR-DC, the turbine generator is located entirely in the Turbine Building, and no safety-related system is close enough to the turbine generator to be affected by the failure of a high or moderate energy line associated with the turbine generator or the low-pressure turbine/condenser connection. Protection of safety-related structures, systems, and components from the effects of turbine-generated missiles are addressed in CESSAR-DC, Section 3.5.1.3.

The source of extraction steam for each stage of feedwater heating is presented below:

Heater	**Extraction Source**
6	H-P turbine
5	H-P turbine
Deaerator	H-P turbine exhaust
3	L-P turbines
2	L-P turbines
1	L-P turbines

Provided in the higher pressure extraction lines are piston-assist, spring-closed ~~swing~~ non-return check valves. The piston-assist, spring-closed actuators are designed to overcome friction and allow the valves to close rapidly on turbine trip. Low-pressure first stage extraction lines are not provided with check valves since installation in the condenser neck would be impractical. However, the low-pressure heaters are provided with anti-flash baffle plates located inside the heaters.

Insert A

The LP turbines are provided with condensate spray cooling to protect the turbine against excessive temperature rise during run-up, no-load and shutdown. It consists of a number of spray jets mounted inside the LP casing in the neighborhood of the exhaust blades. The jets are arranged to spray uniformly over the internal walls and to form a film of water on the vertical surfaces. Spraying is started automatically when the steam flow rate drops below about 10% of the full load flow rate.

Generator rating, temperature rise, and class of insulation are in accordance with IEEE standards. Excitation is provided by a shaft-driven alternator with its output rectified.

A conventional oil-sealed hydrogen cooling system provides rotor cooling. The stator conductors are water cooled by a stator water cooling system. Differential relays protect the generator against electrical faults.

The hydrogen bulk storage facility is located outdoors. Hydrogen is supplied from high-pressure storage tanks and an electrolysis hydrogen/oxygen generator.

In order to prevent explosions or fires, the hydrogen piping and the main generator are checked for leaks and then purged with CO_2 to remove all air and oxygen before the introduction of hydrogen. The hydrogen purged from the generator is vented through the Turbine Building roof and dissipates in the outside air. Provisions are included at various points in the distribution system to allow for CO_2 purging and safe venting of the hydrogen in the generator and piping prior to maintenance.

Attachment to CESSAR-DC (Page 10.2-2)

Insert A

These non-return check valves are capable of closing within a time period to maintain stable turbine speeds in the event of a turbine generator system trip.

receives the three signals and permits propagation of the signal demanding the smaller valve opening. The desired speed reference is manually selected using pushbuttons mounted on the operating panel. Speed references are provided for steady-state operation at the speeds required for thermal soaking holds, as well as at rated speed. A pushbutton is also provided that, when pushed and held, overspeeds the turbine for purposes of testing the overspeed protective equipment. The maximum overspeed that the unit will reach should the pushbutton be held down does not exceed the turbine overspeed capabilities. The machine coasts down to rated speed when the pushbutton is released. A circuit is incorporated in the speed control unit to slowly vary the turbine speed above and below hold speeds that are near bucket critical speeds to avoid the possibility of extended operation in a resonant condition. Discrete acceleration reference signals are selected manually to provide for controlled rotor acceleration during startup. Two independent rotor speed circuits are provided for redundancy, and fail-safe circuitry protects the turbine in the event of failure of the primary circuit. ^ Insert B E

The turbine overspeed protection is divided into two basic categories of mechanical overspeed protection in the turbine and electrical overspeed protection in the EHC controller.

Mechanical overspeed protection, which is independent of the EHC controller is provided by the mechanical overspeed trip mechanism, which is located in the turbine front standard on the end of the control rotor stub shaft. The over-speed trip device consists of an unbalanced ring, which is actuated by centrifugal force against the force of a spring when the turbine overspeeds. This movement puts the ring in an eccentric position so that it strikes the trip finger of the mechanical trip linkage which operates the mechanical trip valve to close all turbine valves. The mechanical overspeed trip device is set to activate at 110% of rated speed.

Electrical overspeed protection, which is set at 111.6% of rated speed, is provided as a backup to the mechanical overspeed trip device. The electrical trip solenoid valves are deenergized to trip the turbine upon receiving an open contact from the EHC which represents an overspeed condition.

In addition to the overspeed protection, control, and trip functions provided by the EHC, a diverse method of tripping is provided by an independent over frequency relay which is used to trip the turbine if the generator frequency reaches approximately 111% of its rated value.

^ Insert C

Attachment to CESSAR-DC (Page 10.2-5)

Insert B

The speed governor for normal speed-load control fully closes the control and intercept valves at 105% of the turbine normal operating speed.

Insert C

The turbine overspeed trips close the main steam stop, control, reheat stop and intercept valves within a time period after a trip signal that precludes an unsafe turbine overspeed condition. These closure times account for the residual steam in the piping between the valves and the turbine.

Question 410.131

a. Confirm that the MSSS design includes the capability to detect and control leakage and isolate portions of the system in the event of excessive leakage or component malfunctions. List the specific instrumentation which provides the initiating signals to close the MSIVs and/or turbine stop valves to limit the release of steam.

b. Provide information which confirms that non-seismic Category I portions of the MSSS or other systems located close to essential portions of the system, or of non-seismic Category I structures that house, support of are close to essential portions of the MSSS, do not preclude operation of the essential portions of the MSSS.

c. Provide a tabulation and descriptive text of all flow paths that branch off the main steam lines between the MSIVs and the turbine stop valves. The descriptive information should include the following for each flow path:

(1) System identification
(2) Maximum steam flow in pounds per hour
(3) Type of shut-off valve(s)
(4) Size of valve(s)
(5) Quality of valve(s)
(6) Design code of valve(s)
(7) Closure time of all valve(s)
(8) Actuation method of valve(s)
(9) Motive power source for the valve actuating mechanism

d. In the event of a main steam line break, termination of steam flow for all systems identified in question c (above), except those that can be used for mitigation of the accident, is required to bring the reactor to a safe cold shutdown. For those systems required for accident mitigation, provide verification that the SAR describes what design features have been incorporated to assure closure of the steam shut-off valve(s), and what operator actions, if any, are required.

e. Provide information that addresses the potential for steam hammer and relief valve discharge loads, and techniques used to minimize such occurrences.

Response 410.131

a. The Main Steam Isolation System is an Engineered Safety Feature (ESF) System whose safety-related instrumentation and controls are part of the Engineered Safety Features Actuation System (ESFAS). The ESFAS is the means by which the Main Steam Supply System (MSSS) is capable of detecting and controlling leakage due to a pipe rupture or component malfunctions. The ESFAS provides the Main Steam Isolation Signal (MSIS) which is the initiating actuation signal to the MSSS to close the Main Steam Isolation Valves (MSIVs), MSIV Bypass Valves, and the automatically actuated valves located upstream of the MSIVs (except the steam-driven Emergency Feedwater Pump steam isolation valves) to limit steam blowdown resulting from a steam line rupture or component malfunction. The signals comprising a MSIS are discussed in CESSAR-DC Chapter 7, "Instrumentation and Controls".

b. As stated in CESSAR-DC Section 10.3.3, safety-related portions of the Main Steam Supply System are contained in Seismic Category I structures. Non-seismic portions of the MSSS and other systems which may interact with essential portions of the MSSS are designed to Seismic Category II requirements as delineated in CESSAR-DC Section 3.2, "Classification of Structures, Components, and Systems". Therefore, failure of non-seismic systems, structures, or components will not preclude operation of the safety-related portions of the MSSS.

c. As shown in CESSAR-DC Figure 10.3.2-1 and described in Section 10.3.2, the following flow paths originate from the MSSS downstream of the MSIVs and upstream of the main steam stop valves:

   1. Turbine Bypass System
   2. Main steam supply to steam reheaters
   3. Main steam supply to deaerator
   4. Main steam supply to the auxiliary steam header

   As indicated in footnote 21 to Table 3.2-1 of CESSAR-DC, all piping, valves, etc. downstream of the MSIVs are designed to ANSI/ASME B31.1 (non-nuclear safety). As such, more specific information pertaining to the isolation valves and pipe line sizing and flow rates of these steam flowpaths is not available until well into the final design process when valve specifications and procurement documents are generated.

Response 410.131 (Cont'd)

d. The following requirement is included in CESSAR-DC Section 10.3.2.2 to confirm satisfactory performance following a steam line break:

> Following a steam line break, either all steam paths downstream of the MSIVs are shown to be isolated by their respective control systems following a Main Steam Isolation Signal (MSIS), or the results of a blowdown through a non-isolated path are shown to be acceptable. An acceptable maximum steam flow from a non-isolated steam path is 10% of the maximum steam flow rate of 19 x 10^6 lb/hr at 1000 psia saturated steam.

This requirement assures valves downstream of the MSIVs will not permit the blowdown of a second steam generator following a secondary line break in the event that a MSIV fails to shut.

Located downstream of the MSIVs, the turbine bypass valves are normally controlled by the Steam Bypass Control System and are capable of remote or local manual operation. The instrumentation and controls for System 80+™, including the Steam Bypass Control System, are discussed in detail in CESSAR-DC Chapter 7.0. CESSAR-DC Figure 7.7-8 "Steam Bypass Control System Block Diagram" indicates that a low T_{AVG} closes or blocks the opening of the turbine bypass valves. Additionally, as stated in CESSAR-DC Section 10.4.4, no single turbine bypass valve has a maximum capacity greater than 1.9 X 10^6 lb/hr at 1000 psia. These features assure the closure of the turbine bypass valves and limit the blowdown through the valves in the event of a secondary steam line break.

e. As stated in CESSAR-DC Section 10.3.2.2, the main steam safety valve discharge piping is arranged and supported such that the limiting loads are not exceeded for normal and relieving conditions. This requirement will be revised to include the atmospheric dump valve discharge piping. In addition, a statement will be added to this section which addresses steam hammer and relief valve discharge loads.

System design features are given in CESSAR-DC Section 10.3 which contribute to minimizing the potential for steam hammer. These design features include the main steam isolation valve bypass valves which permit steam plant warmup and pressure equalization across the MSIVs prior to opening the MSIVs. An equalization header is provided downstream of the MSIVs and upstream of the turbine stop and control valves to permit a full-closure test at 90 percent power of one of the high pressure turbine stop valves during operation without imposing a severe pressure/load transient on one of the steam generators. A main steam drainage system is provided to effectively remove water from the system prior to and during startup, shutdown, and operation. The main steam safety valves and atmospheric dump valves are arranged such that any condensate in the line between these valves and the main steam lines drains back to the main steam lines.

The equalization header is sized to allow full closure, at 90% power, of one of the high-pressure turbine stop valves without imposing a severe pressure/load transient on one of the steam generators. I

C. There are no isolation valves in the main steam lines between the steam generators and the Main Steam Safety Valves. The steam line ΔP between the steam generator and the safety valves is minimized. A

D. The Main Steam Isolation Valves (MSIVs), Main Steam Safety Valves, Atmospheric Dump Valves (ADVs), MSIV Bypass Valves, Main Feedwater Isolation Valves (MFIVs), and the Blowdown Isolation Valves are protected against internally generated missiles or the effects resulting from a high energy pipe rupture (e.g., pipe whip, jet impingement and steam environment) such that these events will not prevent the valves from performing their requisite safety functions. I

E. The Main Steam Safety Valves are installed in accordance with the applicable provisions of the ASME Boiler and Pressure Vessel Code Section III-Division 1, Nuclear Power Plant Components (Subsection NC-Class 2 Components). A

F. The Main Steam Safety Valve and Atmospheric Dump Valve discharge piping is arranged and supported to minimize discharge loads such that the limiting loads are not exceeded for normal and relieving conditions. I

G. In the combined event of a steam line break and the loss of power or a steam generator tube rupture and loss of power, personnel access to the manual operator of the intact Atmospheric Dump Valves on the intact steam generator is possible. A

H. Each automatically actuated valve, located upstream of the MSIVs, will close on a main steam isolation signal except as required for the steam-driven emergency feedwater pumps. The maximum allowable flow rate per line is 1.9×10^6 lb/hr. I A

I. The system piping is designed to allow cleaning for the removal of foreign material and rust prior to operation and to prevent introduction of this material into the steam generator and turbine. Chemical cleaning or hand cleaning may be employed. During chemical cleaning, no fluid shall enter the steam generators. Suitable bypass piping is provided where applicable. I A

J. Emergency feedwater pump turbine steam supplies are taken off the main steam lines upstream of the Main Steam Isolation Valves. I

K. Following a steam line break, either all steam paths downstream of the MSIVs are shown to be isolated by their respective control systems following a Main Steam Isolation Signal (MSIS), or the results of a blowdown through a non-isolated path are shown to be acceptable. An acceptable maximum steam flow from a non-isolated steam path is 10% of Maximum Steam Rate*. It is not required that the control systems for downstream valves nor the downstream valves themselves be designed to ASME Code, Section III, Seismic Category I, IEEE Standard 279 or IEEE Standard 300 Criteria. A I

L. The Main Steam Safety Valves [and Atmospheric Dump Valves] are arranged such that any condensate in the line between the[se] ~~safety~~ valves and [the] main steam line[s] drains back to the main steam line[s].

M. The main steam piping is arranged to minimize the number of low points.

N. The pressure drop at the maximum guaranteed steam flow rate does not cause the inlet moisture level at the turbine stop valve to exceed 0.5%, or a thermal analysis of the steam system is performed and the calculated moisture level at the turbine stop valve is acceptable to the turbine vendor.

O. The drainage system for main steam piping is designed to remove water prior to and during initial rolling of the turbine and during shutdown. Drain system flow velocity does not exceed 10 ft/sec.

1. A drain is located at each low point in the main steam piping system where water may collect during startup, shutdown, or normal operation of a unit. The position of the piping in both hot and cold conditions is considered. In long runs of piping with no special low point, a low point drain is installed at the turbine end of the section. If the main steam line is split into more than one lead going into the turbine, then each of these leads and the main header are reviewed for low points. The low point drain consists of a drain pot with a minimum diameter of 12 inches. A

2. Low point drains are provided upstream of each of the Main Steam Isolation Valves.

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* Maximum Steam Rate = 19 x 10^6 lb/hr @ 1000 psia saturated steam. I

3. The routing of drain piping is downward, and the slope of all horizontal pipes in the direction of the flow is downward at a minimum of 1/8 inch per foot of pipe.

4. Main Steam System drains are routed to the condenser.

5. Main Steam System drains are not connected to manifold serving drains from sources downstream of the turbine throttle valve.

6. Two valves are installed in series in each drain line. One of these valves is pneumatically operated and arranged to fail open. This valve is located as close as possible to the main steam header or lead to reduce the amount of water trapped upstream of the closed drain valve. The second valve is manual and locked open.

7. Traps are not used for drains essential to system operation unless they are used in conjunction with a fully automatic redundant drain system.

8. All Main Steam System drain lines and valve ports have a minimum inside diameter of one inch to minimize the risk of plugging by foreign material.

9. Safety-related Main Steam System drains, located in the region from the steam generator to the MSIV, are provided with remote motor-operated valves. Non-safety-related Main Steam System drains, MSIV to turbine generator, are automatically operated.

P. The Main Steam Isolation Valves for each steam generator are arranged such that a maximum of 2,000 cubic feet (total for two steam lines per steam generator) is contained in the piping between each steam generator and its associated MSIVs. This volume includes all lines off of the main steam line up to their isolation valves. A

Q. The main steam lines are arranged such that a maximum of 14,000 cubic feet is contained between the MSIVs and the Turbine Stop Valves. This volume includes all lines off of the main steam line up to their isolation valves.

R. A discharge connection is provided on the steam generator main steam line to allow venting of nitrogen gas during steam generator fill operations while still maintaining a pressure of about 5 psig in the steam generator.

S. The MSSS is designed to minimize the potential for steam hammer.

The isolation valve operators and controls are designed to the applicable parts of IEEE Standard 279-1971 and IEEE Standard 308-1980. I

H. The ADVs are designed, fabricated and installed such that the requirements for In-service Testing and Inspection of ASME Section XI, Subsection IWV can be met.

I. The ADVs are classified "active" and conform to design requirements meeting the intent of NUREG-0800.

10.3.2.3.3 Instrumentation and Control

The control system minimizes the number of instrumentation control functions and control loops required to perform the essential control functions. Further, the number of different types of instrumentation and control components used in the system is minimized and coordinated with the remainder of the plant to reduce the maintenance effort and the number of spare parts which must be stocked.

Each subsystem automatic control loop, such as the controls for the bypass valves is analyzed to establish that it meets its functional requirements and has adequate stability margin.

10.3.2.3.3.1 Main Steam Isolation Valves (MSIVs) A

A. Control of the main steam isolation valves is accomplished by a separate system independent of the protection system.

B. Operator interface to the isolation valve is provided locally, in the Main Control Room (MCR) and at the Remote Shutdown Panel (RSP). The following are provided:

1. The capability to manually open and close the valve.

2. The capability to test the valve operation (MCR only).

3. Valve position indication (open/close indicating lights).

C. The MSIVs are interlocked to close upon initiation of a main steam isolation signal (redundant). The parameters which initiate a Main Steam Isolation Signal are given in Chapter 7.

D. Each Main Steam Isolation Valve (MSIV) has two physically separate and electrically independent closure solenoids in order to provide redundant means of valve operation. A Main Steam Isolation Signal (MSIS) is provided to each solenoid.

E. An electrical or mechanical malfunction of one solenoid does not prevent the MSIV from closing.

Question 410.132

Main Condensers (MC)

a. Provide information regarding measures provided to prevent loss of vacuum, corrosion and/or erosion of MC tubes. Describe any procedures that are followed to detect and correct these conditions.

b. Describe the instrument and control features provided for the MC system to verify that the MC is operating in a correct mode.

c. Verify that means have been provided for detecting, controlling and correcting condenser cooling water leakage into the condensate. Verify that permissible levels of cooling water inleakage have been defined to assure that condensate/feedwater quality is maintained within safe limits.

Response 410.132

a. The Main Vacuum System, described in CESSAR-DC section 10.4.2, is used to maintain adequate condenser vacuum for proper turbine operation during startup and normal plant operation. Loss of condenser vacuum is indicated when condenser pressure meets or exceeds its setpoint value. Loss of condenser vacuum can occur from loss of Main Vacuum, loss of Circulating Water, or excess air in-leakage. The safety related consequences of a loss of condenser vacuum and subsequent turbine trip is analyzed in CESSAR-DC section 15.2.

Prevention of loss of vacuum, and reduction of corrosion and erosion of Main Condenser tubes is accomplished by a combination of the following:

- selection of condenser tube, tubesheet, shell and waterbox materials based on site-specific water chemistry, as described in CESSAR-DC sections 10.3.6.2 and 10.4.1.2 parts b,c, and f. Material selection requirements specified in CESSAR-DC are based on utility industry operating experience, EPRI ALWR requirements and Heat Exchange Institute (HEI) standards.
- provisions for chemical injection into the condenser for biofouling control, as described in section 10.4.1.2 and dependent on site-specific requirements, and appropriate sampling of the circulating water system.
- use of an automatic condenser cleaning system.

Response 410.132 (cont'd)

Initial testing of Main Condenser components is done in accordance with HEI Standards for Steam Surface Condensers. The condenser is designed to be capable of being filled with water for hydrotests. The condenser shells, hotwells, and waterboxes are provided with access openings to permit inspection and repairs; periodic visual inspections of and preventive maintenance on condenser components are employed.

b. Hotwell level and pressure indications are provided locally. Associated alarms are provided in the control room for each condenser shell. The condensate level in the hotwell is maintained within proper limits by automatically transferring condensate to or from the condensate storage system. Condensate temperature (measured in the Condensate System), condenser pressure (with high condenser backpressure alarm), and circulating water temperature, pressure, and differential pressure from waterbox to waterbox are monitored and used to verify Main Condenser operation.

c. Leak detection trays are included at all tube-to-tubesheet interfaces, and provisions for early leak detection are provided at tubesheet trays and in each hotwell section, as described in section 10.4.1.2. The condenser hotwell is divided into three sections to allow for leak detection and location. The condenser hotwell in each shell contains conductivity cells to provide detection and location of condenser tube leaks. Rejection of hotwell condensate to the condensate drain tank is blocked automatically upon an indication of high hotwell conductivity. This feature prevents transfer of impurities into the condensate drain tank in the event of condenser tube leakage. The condenser and the circulating water system are designed such that isolation of a portion of the tubes to permit repair of leaks is possible.

The plant process sampling system provides information on condensate/feedwater quality. Decrease in condensate quality is an indication of condenser circulating (cooling) water leakage into the condensate. CESSAR-DC sections 9.2.3, Demineralized Water Makeup System, 9.3.2, Process Sampling System, 10.3.5, Secondary Water Chemistry and 10.4.6, Condensate Cleanup System, give further details of water quality parameters and system operating limits.

The attached changes to CESSAR-DC section 10.4.1, Main Condenser, will be made to clarify these issues.

RAI 410.132

During normal operation and shutdown, the main condenser will have no radioactive contaminants inventory. Radioactive contaminants can only be obtained through primary to secondary system leakage due to steam generator tube leaks. A discussion of the radiological aspects of primary to secondary leakage, including operating concentrations of radioactive contaminants, is included in Chapter 11. There is no hydrogen buildup in the main condenser. A

The main condenser is non-safety-related.

A leak or failure in the condenser shell would allow condensate to drain out, but the pits located below the condenser will hold more water than the condensate hotwell volume. The flooding due to a loss of condenser water box or circulating water piping would be limited to the turbine building which contains no safety-related equipment.

A failure in the recirculating water system or the main condenser large enough to cause flooding will be detected by high level alarms in the turbine building sumps. The operator can isolate the appropriate equipment. I

10.4.1.4 Tests and Inspections

Insert A > The main condenser is tested in accordance with the Heat Exchanger Institute Standards for Steam Surface Condensers. ~~Proper operation of the system after startup will assure system integrity and further testing of components in continuous use will not be necessary. Periodic visual inspections and preventive maintenance are conducted following normal industrial practice.~~ A E

10.4.1.5 Instrumentation Application

All of the instrumentation for this system is operating instrumentation and none is required for safe shutdown of the reactor. ^ Insert B A E

10.4.2 MAIN VACUUM SYSTEM

10.4.2.1 Design Bases

The Main Vacuum System is designed to: A

A. Remove air and other noncondensable gases from the condenser.

B. Maintain adequate condenser vacuum for proper turbine operation during startup and normal operation.

__Attachment to CESSAR-DC Change Package for Section 10.4.1__

Insert A
Insert the following into section 10.4.1.4, Tests and Inspections (location as indicated on page 10.4-4):

The condenser is designed to be capable of being filled with water for hydrotests. The condenser shells, hotwells, and waterboxes are provided with access openings to permit inspection and repairs; periodic visual inspections of and preventive maintenance on condenser components are conducted following normal industrial practice. The condenser and the circulating water system are designed such that isolation of a portion of the tubes to permit repair of leaks is possible.

Insert B
Insert the following into section 10.4.1.5, Instrumentation Application (location as indicated on page 10.4-4):

Sufficient instrumentation is provided throughout the plant power generation systems to facilitate an accurate heat energy balance on the plant.

Hotwell level and pressure indications are provided locally, and associated alarms are provided in the control room for each condenser shell. The condensate level in the hotwell is maintained within proper limits by automatically transferring condensate to or from the condensate storage system. Condensate temperature (measured in the Condensate System), condenser pressure (with high condenser backpressure alarm), circulating water temperature and pressure, and differential pressure from waterbox to waterbox are monitored and used to verify Main Condenser operation.

The condenser hotwell in each shell contains conductivity cells to provide detection and location of condenser tube leaks. Rejection of hotwell condensate to the condensate drain tank is blocked automatically upon an indication of high hotwell conductivity. This prevents transfer of impurities into the condensate drain tank in the event of condenser tube leakage.

Turbine trip is activated on loss of Main Condenser vacuum when condenser pressure reaches or exceeds the setpoint.

Question 410.133

Circulating Water System (CWS)

a. Verify that the design includes provisions to minimize hydraulic transients and their effect upon the functional capability and the integrity of CWS components.

b. Verify that the capability exists to detect leaks and secure the CWS quickly and effectively.

Response 410.133

a. The condenser circulating water system (CWS) is designed to minimize the potential for water hammer by providing adequate filling and high point venting. Valve opening/closing times are selected to minimize water hammer effects. All CWS piping and components are designed to meet the requirements of ANSI/ASME B31.1.

b. The System 80+™ main condenser waterbox is divided into sections. Conductivity monitors in each main condenser hotwell shell are used to detect leakage of circulating water (see response to RAI 410.132 and resultant change package for CESSAR-DC section 10.4.1). Valving is provided such that each of the condenser waterbox sections can be isolated and the unit operated at partial load, thus preventing the introduction of large amounts of non-condensate quality water into the condensate and feedwater system.

   CESSAR-DC section 10.4.1.3 describes features of the System 80+™ design which are used to detect and contain flooding due to failure of the circulating water system. The pits below the main condenser will hold more water than the condensate hotwell volume; flooding due to loss of condenser water box or circulating water piping would be limited to the turbine building, which contains no safety-related equipment. A failure in the circulating water system or the main condenser large enough to cause flooding will be detected by high level alarms in the turbine building sumps. The operator can isolate the appropriate equipment.

CESSAR-DC section 10.4.5 shall be changed to clarify these design features.

the pumps is maintained within the temperature and purity limits established by the manufacturer. High quality cooling water for the pump bearings is provided in sufficient quantity to maintain bearing temperatures within manufacturers limits under full pump output during the hottest days of the year. Separate flow paths, each with their own pressure control, are provided for each pump support system requiring cooling water (e.g., thrust bearing cooling, seal water cooling, wear ring flushing). E

Valving is provided such that each of the six condenser waterbox sections can be isolated and the unit operated at partial load. Means are provided for entry into the waterboxes and circulating water piping for repair and cleaning. Entry provisions allow cleaning within one eight-hour shift. Drains are available such that the circulating water system can be drained within eight hours. I

Blowdown is provided to control the concentration factor of cooling tower solids. A throttling valve allows regulation of the blowdown flow.

Acid is injected in the cooling tower inlet header. Biocide and scale inhibitor are injected into the basins. Water treatment for the circulating water system is based on site makeup water chemistry, blowdown requirements, environmental regulations, and system materials. Consideration is given to the need for biogrowth control, pH control, and scale buildup. Water treatment follows the options in EPRI report CS-2276, "Design and Operating Guidelines Manual for Cooling Water Treatment."

Makeup flow to each cooling tower basin is regulated by a throttling valve. Each tower is provided with two 100% capacity makeup pumps. Filters at the makeup intake structure prevent debris from entering the pumps. The suction filters can be cleaned without loss of makeup flow. Pump discharge strainers additionally remove debris which might enter the circulating water system. Warm water from the condenser outlet is used to prevent icing of the intake structure during winter months. The intake structure is separated from the discharge structure to minimize the potential for recirculation. E

10.4.5.3 Safety Evaluation

The Condenser Circulating Water System does not perform any safety functions. Thus reliance on this system was not assumed in the safety analysis.

10.4.5.4 Tests and Inspections

Prior to startup, all piping is hydrostatically tested and flushed to applicable codes and standards. A full power

Attachment to CESSAR-DC Change Package for Section 10.4.5

Insert the following into section 10.4.5.2 (locations as indicated on page 10.4-13):

Insert A

The Main Condenser waterbox is divided into sections. To prevent the introduction of non-condensate quality water into the condensate and feedwater system, conductivity monitors in each main condenser hotwell shell are used to detect leakage of circulating water, as described in Section 10.4.1.5.

Insert B

The condenser circulating water system (CWS) is designed to minimize the potential for water hammer by providing adequate filling and high point venting. Valve opening/closing times are selected to minimize water hammer effects. All CWS piping and components are designed to meet the requirements of ANSI/ASME B31.1.

Question 410.134

Condensate and Feedwater System

a. Verify that the s... piping is designed according to the requirements o... ral Design Criterion 4 and consistent with Branch Technical Position ASB 10-2 to preclude hydraulic instabilities from occurring in the piping for all modes of operation.

b. Verify that the feedwater control valve and controller designs with respect to waterhammer potential have been addressed and that plant operating and maintenance procedures have been reviewed to assure that precautions to avoid waterhammer occurrences have been provided.

c. Verify that the capability exists to detect and control leakage from the system.

Response 410.134

a. Branch Technical Position ASB 10-2 requires that certain design capability and verification be provided. For preheat steam generator designs, the following guidelines are specified; methods employed by the System 80+™ design to satisfy these requirements are described following each requirement.

- *Minimize the horizontal lengths of feedwater piping between the steam generator and the vertical run of piping by providing downward turning elbows immediately upstream of the main and auxiliary feedwater nozzles.* System arrangement features of the System 80+ main feedwater system are described in CESSAR-DC section 10.4.7.2.6. One of the arrangement requirements states that a 90-degree elbow facing downward is attached to each steam generator (economizer and downcomer) feedwater nozzle. This precaution aids in the prevention of water hammer. Emergency feedwater (EFW) piping arrangement is described in CESSAR-DC section 10.4.9.2. EFW piping is connected to the downcomer feedwater line, which then continuously rises up to the 90-degree elbow attached to the downcomer feedwater nozzle.

- *Provide a check valve upstream of the auxiliary feedwater connection to the top feedwater line.* CESSAR-DC Figure 10.4.9-1, Emergency Feedwater System Piping and Instrumentation Diagram, shows the check valves located upstream of the downcomer feedwater line connection. Descriptions of EFW piping connections to main feedwater piping are contained in section 10.4.7.2.6, item G, and in 10.4.9.1.2, items M and R.

- *Maintain the top feedwater line full at all times.* The System 80+ steam generator design includes design features to help maintain the top feedwater (downcomer) line full of water. Response to NRC RAI 210.92 contains other information about steam generator design.

- *Perform tests acceptable to NRC to verify that unacceptable feedwater hammer will not occur using plant operating procedures for normal and emergency restoration of steam generator water level following loss of normal feedwater. Also perform a water hammer test at (the power level at which feedwater flow is transferred from the auxiliary feedwater nozzle to the main feedwater nozzle)% of power by using feedwater through the auxiliary feedwater (top) nozzle at the lowest feedwater temperature that the plant standard operating procedure (SOP) allows and then switching the feedwater at that temperature from the auxiliary feedwater to the main feedwater (bottom) nozzle by following the SOP, and submit the results of such tests.* CESSAR-DC sections 14.2.12.1.63 and 14.2.12.4.13 describe the tests for water hammer in the downcomer and economizer feedwater lines. These tests have been conducted successfully at similar facilities.

A statement will be added to CESSAR-DC section 10.4.7.2.7 to indicate that feedwater system piping is designed to preclude waterhammer.

b. The key characteristic of control valves which can affect waterhammer is valve stroke time. Downcomer and economizer control valve stroke times are selected to preclude unacceptable waterhammer. CESSAR-DC will be revised to include statements on control valves and controllers.

Completion of detailed plant operating and maintenance procedures is outside the scope of design certification; however, a statement will be added to CESSAR-DC requiring that adequate provisions for avoidance of waterhammer be provided in developing plant operating and maintenance procedures.

Response 410.134 (continued)

c. System leakage is collected and processed by the Equipment and Floor Drainage System, described in CESSAR-DC Section 9.3.3. High level alarms on Nuclear Annex, Turbine building, and Reactor Subsphere sumps provide indication to plant operations personnel of excessive system leakage.

RAI 410.134

I. Plant operation can continue at reduced power with loss of one operating feedwater pump. A

J. Plant operation can continue at 100% power with loss of one operating condensate pump. I

K. The feedwater and condensate system is designed to avoid erosion damage. The design and layout of piping systems considers the effect on the piping material from fluid velocity, bend location and the location of flash points. The following velocity guidelines are used: A I

1. Pipe velocity ≤ 20 ft/sec.

2. Feedwater heater inlet flow velocity ≤ 12 ft/sec. A

3. Condensate pump suction line velocity ≤ 5 ft/sec.

L. The feedwater system piping and associated supports and restraints shall be designed so that a single adverse event, such as a ruptured feedwater line or a closed isolation valve can occur without:

1. Initiating a Loss-of-Coolant incident.

2. Causing failure of the other steam generator's safety class steam and feedwater lines, Main Steam Isolation Valves (MSIVs), safety valves, Main Feedwater Isolation Valves (MFIVs), Steam Generator Blowdown Isolation Valves, or Atmospheric Dump Valves (ADVs).

3. Reducing the capability of any of the Engineered Safety Features Actuation Systems or the Plant Protection System. I

4. Transmitting excessive loads to the containment pressure boundary.

5. Compromising the function of the plant control room.

6. Precluding an orderly cooldown of the RCS.

→ M.

10.4.7.2.6 System Arrangement

A. Redundant Feedwater System Isolation Valves meeting single failure criteria are provided in any feedwater piping interconnecting the steam generators to preclude blowdown of both steam generators following a postulated pipe rupture. A

RAI 410.134

feedwater line or any other system pipeline, single failure criteria will not be exceeded with regard to safe shutdown of the plant. A

6. Each of the two economizer feedwater lines to the steam generator economizer feedwater nozzles is a 20-inch line based on a flow of 50% of full power flow at normal full power steam generator pressure (1000 psia). Upstream, the single economizer line is sized for 100% of full power flow. I

7. The downcomer feedwater line is an 8-inch line based on the following:

   a. The downcomer feedwater line is sized for a flow of at least 10% of full power flow at normal full power steam generator pressure (1000 psia) at 100% power. A

   b. During plant startup, the downcomer feedwater line accommodates all feedwater flow below the temperature of 200°F.

   c. During plant startup, the downcomer feedwater line accommodates all feedwater flow up to 20% of full power.

→ Insert B

B. Main Feedwater Isolation Valves and Check Valves I

1. The Main Feedwater Isolation Valves (MFIVs) are designed for complete termination of forward feedwater flow within 5 seconds after receipt of a Main Steam Isolation Signal (MSIS), even if the effects of a single failure are imposed.

2. The Main Feedwater Isolation Valves (MFIVs), check valves, and associated supports and restraints are designed to ASME Section III, Class 2 and are Seismic Category I. A

3. The MFIVs are capable of being in-service tested in accordance with ASME Code Section XI, Subsection IWV.

4. The MFIVs in each main feedwater line are remotely operated and capable of maintaining a leak rate of less than 1000 cc/hour under the main feedwater line pressure, temperature and flow resulting from the transient conditions associated with a postulated pipe break in either direction of the valves. I A

Attachment 1 to CESSAR-DC Change Package for Section 10.4.7

Insert A

Insert the following into section 10.4.7.2.5, System Performance (location as indicated on page 10.4-21):

M. System operating and maintenance procedures shall be developed with adequate provisions for avoidance of water hammer.

<u>Attachment 2 to CESSAR-DC Change Package for Section 10.4.7</u>

<u>Insert B</u>

Insert the following into section 10.4.7.2.7, Piping, Valves, Equipment and Instrumentation (location as indicated on page 10.4-24):

8. Main feedwater pipe routing is designed to preclude water hammer.

9. Valve stroke times for feedwater control valves are selected to prevent unacceptable water hammer.

Question 410.135

a. In calculating the primary and secondary coolant activities CESSAR assumes a primary to secondary coolant leakage of 75 lbs/hr rather than the NUREG-0017 guideline value of 100 lbs/hr. Explain the basis for the CESSAR assumption.

b. Section 2.2.10.1 of NUREG-0017 indicates that releases from containment are based on 4 purges/yr and a 1000 ft^3/min continuous ventilation rate for plants equipped with small-diameter purge lines. CESSAR Section 11.3.6.1 assumes 2 purges/year and a continuous venting rate of 12.5 scfm(1250 scfm release rate operating 1% of the time). Explain the basis for the CESSAR assumptions.

c. In the calculation of secondary coolant concentrations, NUREG-0017 assumes .1% steam carryover for particulates. CESSAR assumes 0.5%. Explain the basis for the CESSAR assumption.

d. In spite of statements made in several sections of the CESSAR to the effect that methodology and assumptions used in the calculation of source terms and releases are consistent with guideline values in NUREG-0017, parameters discussed above were not consistent with NUREG-0017. Provide the values of all relevant parameters used a) in the establishment of primary and secondary coolant concentrations, and b) in the execution of the GALE Code. If those are different from the guideline values provided in NUREG-0017, provide the basis for their use. Specify the type of treatment used to control secondary coolant chemistry. Guidance as to the data needed by the staff for radioactive source term calculations is provided in Appendix B of Regulatory Guide 1.112.

Response 410.135

a. The assumption of a primary to secondary side leakage of 75 gpd is consistent with guidelines provided in NUREG-0017, Revision 1, Section 2.2.3.

b. Section 2.2.9.1 of NUREG-0017, Revision 1, indicates that releases from containment are based on 2 purges/year with a continuous ventilation rate dependent on plant design.

c. The assumption of 0.5% steam carryover is based on NUREG-0017, Revision 1, Section 2.2.3.

d. The apparent discrepancies identified above are based on the usage of Revision 0 of NUREG-0017 not Revision 1 of the NUREG-0017. The assumptions and methodology used to calculate the primary and secondary coolant concentrations are consistent with guidance provided in NUREG-0017, Revision 1 as reference in Section 11.1 of the CESSAR-DC.

Question 410.136

a. General: the design of the liquid waste management system appears to be in a conceptual stage. It does not include the detail necessary for a review in accordance with the requirements of SRP Section 11.2. For design certification, the CESSAR is expected to contain the type and depth of information delineated in SRP Section 11.2, Part I, Items 1 through 10.

b. Provide the design basis for the system with regard to the percentage of failed fuel.

c. Provide P&ID drawings for the Liquid Waste Management System.

d. One of the specific criteria necessary to meet the relevant requirements of the Commission regulations is that the concentrations of radioactive materials in liquid effluents released to an unrestricted area should not exceed the limits in 10 CFR Part 20, Appendix B, Table II, Column 2. Provide radionuclide discharge concentrations for normal liquid releases, including operational occurrences, for expected discharges and dilution factors. Provide conservative site specific dilution factors required to maintain the above concentrations. Note that the source term should be based on design basis failed fuel rate.

e. Section 11.2.1.1(C) states that "..the consequences of accidental releases from the LWMS must not exceed the Standards of Protection Against Radiation, 10 CFR 20." Provide the limiting values referred, and include information on the assumptions, type of accidents considered, methodology, and analysis to demonstrate compliance with this design criterion. A reference to a section of the CESSAR where this specific information may be found will be adequate. Note that section 15.7.1 has been deleted from the CESSAR.

f. Provide the functional design basis requirements for the liquid waste management system, and a design evaluation addressing these requirements.

g. Provide a design evaluation to demonstrate the capability of the system to process waste in the event of a single major equipment failure, to accept additional waste during operations which result in excessive liquid waste operation, and to process wastes at design basis fission product leakage levels, i.e., from 1% of the fuel producing power.

Response 410.136

a. The issue is considered to be a question of level-of-detail necessary for design certification. The detailed design of the liquid, gaseous, and solid waste management system will depend on vendor supplied information, radwaste process technology at the time of detailed design and site specific parameters, such as dilution flow, χ/Q dispersion factors, and local requirements for disposal sites. Adequate information has been provided through design criteria and evaluations, required features, process flow diagrams, system descriptions, system operation descriptions, inspection and testing requirements, instrumentation requirements and release analysis, including estimated quantity of radioactivity released, sources, estimated volumes, and activity levels, and volumes of inputs, to make a safety determination for design certification.

b. The Liquid Waste Management System is design based on a design basis failed fuel rate of 0.25%.

c. Process flow diagrams for the Liquid Waste Management System are provided in CESSAR-DC Figure 11.2-1. Detailed P&ID drawings require procurement level information, developed during the final design process, which is not considered necessary at this time considering the minor safety significance of this system.

d. Section 11.2 will be expanded to include the analysis and methodology to calculate the concentration of radionuclide in liquid effluents based on the design basis failed fuel rate of 0.25% and the expected failed fuel rate. The liquid effluent concentrations are in compliance with the limits in 10 CFR Part 20, Appendix B, Table II, Column 2. Concentrations of liquid effluents at the design basis source term can be controlled within 10 CFR Part 20 limits through operational techniques such as, recirculation and further processing of a batch by the Liquid Waste Manage Management or by the reduction of the discharge rate. This future addition is attached.

e. The Radwaste Building, which will house the Liquid Waste Management System (LWMS), will be designed in accordance with the requirements per Regulatory Guide 1.143. Regulatory Guide 1.143 does not require a dose consequence analysis since the liquid released due to a LWMS failure would be retained in the Radwaste Building.

f. The CESSAR-DC Section 11.2.1 will be expanded to include a statement to clarify the functional design basis. The design basis evaluation is enveloped by the responses to questions 410.136(d) and 410.136(e) which demonstrate compliance with 10 CFR Part 20 limits. A revision of section 11.2.1 is attached.

g. The Liquid Waste Management System has been designed with sufficient redundancy and surge capacity to accommodate increased processing requirements or a single major failure. In addition, temporary hookup connections for temporary equipment is provided for processing during occurrences beyond the processing capability of the design.

Question 410.137

a. General: The design of the gaseous waste management system appears to be in a conceptual stage. It does not include the detail necessary for a thorough review in accordance with the requirements of SRP Section 11.3. For design certification, the CESSAR is expected to contain the type and depth of information delineated in SRP Section 11.3, Part I, Items 1 through 6.

b. Provide the design basis of the system with regard to the percent of failed fuel.

c. Provide the functional design basis requirement for the Gaseous Waste Management System and a design evaluation addressing these requirements.

d. Provide P&ID drawings for the Gaseous Waste Management System.

e. The design bases for the system should also include: General Design Criterion 3, as it relates to providing protection to gaseous handling and treatment systems from the effects of an explosive mixture of hydrogen or oxygen, and General Design Criterion 61, as it relates to radioactivity control in gaseous waste management systems and ventilation systems associated with fuel storage and handling areas. Include these design criteria and address them in the design evaluation section.

f. One of the design requirements of the gaseous waste treatment system is compliance with 10 CFR 20.106, as it relates to radioactivity in effluents to unrestricted areas. Provide the assumptions, methodology, and analysis to demonstrate that the concentrations of radioactive materials is gaseous effluents released to an unrestricted area do not exceed the limits specified in 10 CFR Part 20, Appendix B, Table II, Column 1. Note that the source term should be based on design basis failed fuel.

g. Gaseous Waste Management Systems, where the potential for an explosive mixture of hydrogen and oxygen exists, should either be designed to withstand the effects of a hydrogen explosion or be provided with dual gas analyzers with automatic control functions to preclude the formation or buildup of explosive material. Address the redundance and the automatic control characteristics of the design. Discuss the settings of alarms associated with the hydrogen explosion protection.

h. Section 11.3.7.2 contains some information on the effects and consequences in a case of GWMS leak or failure. Provide the conservative assumptions used in the analysis and the basis for the atmospheric dispersion factor.

Response 410.137

a. The issue is considered to be a question of level-of-detail necessary for design certification. The detailed design of the liquid, gaseous, and solid waste management system will depend on vendor supplied information, radwaste process technology at the time of detailed design and site specific parameters, such as dilution flow, X/Q dispersion factors, and local requirements for disposal sites. Adequate information has been provided through design criteria and evaluations, required features, process flow diagrams, system descriptions, system operation descriptions, inspection and testing requirements, instrumentation requirements and release analysis, including estimated quantity of radioactivity released, sources, estimated volumes, and activity levels, and volumes of inputs, to make a safety determination for design certification. The design requirements contained in CESSAR-DC will be verified throughout the detailed design and construction of the waste management systems through inspection, test, analysis and acceptance criteria (ITAAC).

b. The Gaseous Waste Management System is design based on a design basis failed fuel rate of 0.25%.

c. The CESSAR-DC Section 11.3.1 will be expanded to include a statement to clarify the functional design basis. The design basis evaluation is enveloped by the responses to questions 410.137(e) and 410.136(f) which demonstrate compliance with 10 CFR Part 20 limits. This future addition is attached.

d. Process flow diagrams for the Gaseous Waste Management System are provided in CESSAR-DC Figure 11.3-1. Detailed P&ID drawings require procurement-level information, developed during the final design process, which is not considered necessary at this time considering the minor safety significance of this system.

e. Section 11.3 of CESSAR-DC has been expanded to include General Design Criteria 3 and 61, as well as the associated design evaluations. A copy of this future addition is attached.

f. This analysis was performed using the source term developed utilizing the methodology presented in Branch Technical Position 11-5 which suggests that for a Waste Gas System Failure that the normal operation source term can be multiplied by seven to yield a "source term which is in good agreement with the design basis source term". This analysis will be added to Section 11.3 of the CESSAR-DC to demonstrate compliance with 10 CFR Part 20, Appendix B, Table II, Column 1 limits. This future addition is attached. [Please note that the X/Q value reported in this change will be increased as the result of the response to RAI 450.09. This future revision will not affect the conclusions of the enclosed revision to Section 11.3]

g. The System 80+™ design utilizes dual gas analyzers with automatic control to preclude the buildup or formation of an explosive mixture of hydrogen and oxygen. Alarms are provided in the control room set to alarm on high hydrogen and oxygen concentration. Nitrogen purge is utilized to maintain the concentration of hydrogen and oxygen less than 4%.

h. Section 11.3.7 will be expanded to include the methodology and assumptions used in this analysis. The atmospheric dispersion factor has been developed to represent the 90th percentile of the meteorological conditions in order to provide a generic conservative dispersion factor for a potential site. The atmospheric dispersion factor is discussed further in Chapters 3 and 15 of the CESSAR-DC. This future addition is attached.

The rate of radioactive liquid discharges will be based on the available dilution and concentrations of 10 CFR 20, Appendix B, Table II.

11.2.6.3 Estimated Doses

The offsite doses estimated to be received by individuals as a result of radioactive liquid releases are presented in Table 11.2-4 and compared with the corresponding limits of 10 CFR 50 Appendix I. The equations in Regulatory Guide 1.109 were implemented in the offsite dose calculations. In addition, it has been assumed that:

A. Fishing and shoreline activities for the maximum exposed individual occur in the immediate vicinity of the discharge point.

B. Drinking water for the maximum exposed individual is taken in the immediate vicinity of the discharge point.

Population doses resulting from radioactive liquid releases are strongly related to site characteristics such as populations served by downstream municipal water intakes and sport and commercial fish harvest rates related to the receiving waters. Therefore, it is necessary to defer population dose projections to site-specific environmental reports. I

11.2.6.4 Cost-Benefit Analysis

The cost-benefit analysis approach stipulated by 10 CFR 50, Appendix I, Paragraph II.D requires that a population dose analysis be performed to demonstrate that the LWMS is designed consistent with the as low as reasonably achievable criterion. Due to the extreme site-specific nature of population dose analyses, the cost-benefit analysis is deferred to site-specific environmental reports.

Although the cost-benefit analysis is deferred to site-specific environmental reports, it is fully expected that the LWMS, as described in this design certification, will pass the as low as reasonably achievable test for most proposed sites without modification. In any case, LWMS modifications resulting from site-specific cost-benefit analyses will reduce the maximum individual doses presented in Table 11.2-4.

Insert A →

410.136(d)

Insert A

11.2.7 CONCENTRATION OF NORMAL EFFLUENTS

The Liquid Waste Management System (LWMS) processes liquid waste prior to release to the environment. Each type of liquid waste is segregated to minimize the potential for mixing and contamination of non-radioactive flow streams. The process liquid radioactive waste is sampled prior to release from Waste Monitor Tanks and radiation monitors are provided in the discharge line to provide for a controlled monitored release. The concentration at the potable water source resulting from releases during normal operation, including anticipated operational occurrences was analyzed to verify that it is less than 10 CFR 20, Appendix B, Table II, Column 2 Maximum Permissible Concentration.

11.2.7.1 Analysis of Effects and Consequences

A. Bases

For the purpose of this analysis, the following assumptions were made to estimate the concentration of the liquid effluent at the potable water source for the design basis source term and the normal operating source term:

1. The system discharges intermittently at an average of approximately 11200 gallons per day shown below.

Type of Waste	Discharge Flow Rate (gpd)	Reference
Shim Bleed	183	Table 11.2-2
Clean Waste	70	Table 11.2-2
Dirty Waste	3200	Table 11.2-2
Detergent Waste	540	NUREG-0017
Turbine Building Drains	7200	NUREG-0017

2. The source term is based the concentration of the liquid in the Waste Monitor Tank. All effluent is assumed to be at this concentration for conservatism.

   a. The LWMS may be occasionally operated at design basis source term conditions. During these conditions, the concentration of the liquid in the Waste Monitor Tank is based on the design basis source term (0.25% failed fuel rate).

   b. Typically, the LWMS is operated at the average normal operating source term calculated using

Insert A (cont'd)

NUREG-0017 methodology. For conservatism, the concentration in the Waste Monitor Tank is calculated based on the shim bleed flow stream processed via the Chemical Volume and Control System (CVCS).

The initial concentration of the shim bleed flow stream, prior to processing via the CVCS, is assumed to be equal to the Primary Coolant Activity (PCA) shown in Table 11.1.1-2. No credit is taken for processing of the flow stream by the LWMS (i.e., the shim bleed is assumed to bypass the LWMS process ion exchangers and filters and be transferred directly from the Equipment Waste Tank to the Waste Monitor Tank for discharge).

The concentration of the shim bleed in the Waste Monitor Tank is calculated as follows:

$$C_t(i) = 1.0\ PCA * \rho / DF(i)_{cvcs}$$

Where:	$C_t(i)$	≡	Concentration in the Waste Monitor Tank (μCi/ml)
	PCA	≡	Primary Coolant Activity (μCi/gm) (See Table 11.1.1-2)
	ρ	≡	Density (gm/ml)
		=	1.0 gm/ml
	$DF(i)_{cvcs}$	≡	Chemical Volume and Control System (CVCS) Total Process Decontamination Factor (See Table 11.2.3 and Figure 11.2-2)
	$DF(i)_{cvcs}$	=	5.0E+5 (Iodine)
		=	4.0E+3 (Cs, Rb)
		=	5.0E+6 (Other)

3. The dilution flow rate is assumed to be 100 scfs, which is consistent with that assumed in Section 11.2.6.

4. In the absence of site specific information for dilution flow. The dilution factor is 1.74 x 10^{-4}, based on a dilution flow rate of 100 scfs and discharge rate of 11200 gpd.

Insert A (cont'd)

B. Methodology

The methodology used to calculate the concentration of the effluent at the potable water source is as follows:

$$C_p(i) = C_t(i) * D_f$$

Where:

$C_p(i)$ = Concentration of the i^{th} isotope at the potable water source (μCi/ml)

Ct(i) = Concentration of the i^{th} isotope in the Waste Monitor Tank (for the design basis failed fuel rate, 0.25%) (μCi/ml)

D_f = Dilution Factor

D_f = F_{dis}/F_{dil}

D_f = 1.74×10^{-4}

F_{dis} = Discharge Flow Rate (gpd)
= 11200 gpd

F_{dil} = Dilution Flow Rate (scfs)
= 100 scfs

C. Results and Conclusions

The estimated concentration of the liquid effluent at the potable water source is shown in Table 11.2-5 and Table 11.2-6. The total average daily concentration of the liquid effluent at the potable water source for the design basis source term and the normal operating source term is 2.76E-1 MPC and 5.81E-2 MPC, respectively. The concentration of isotopes at the potable water source, for both the design basis and normal operating source terms conditions, is well within 10 CFR 20 guidelines.

The rate of radioactive liquid discharges will be based on the available dilution flow and the concentrations of 10 CFR 20, Appendix B, Table II, Column 2. For a dilution flow of 100 scfs, the maximum allowable discharge rate of liquid effluent from the LWMS, during design basis source term conditions and normal operating source term conditions, is approximately 4.05E+4 gpd and 1.92E+5 gpd, respectively.

410.136(d)

Insert A (cont'd)

The Owner Operator will develop procedures for the operation of the LWMS and release of radioactive liquid effluents from the LWMS to ensure that the concentration of the liquid effluents at the potable water source are within 10 CFR 20 guidelines.

Table 11.2-5: Design Basis Average Daily Liquid Effluent Concentration (a)

Nuclide	$C_p(i)$ (µCi/ml)	MPC(i) (µCi/ml)	FMPC(i)
Br-83	6.77E-12	3.00E-06	2.26E-06
Br-84	3.30E-10	3.00E-06	1.10E-04
Br-85	3.82E-11	3.00E-06	1.27E-05
Rb-88	6.43E-10	3.00E-06	2.14E-04
Rb-89	7.12E-10	3.00E-06	2.37E-04
Sr-89	2.08E-11	3.00E-06	6.95E-06
Sr-90	1.30E-12	3.00E-07	4.34E-06
Sr-91	1.29E-11	7.00E-05	1.84E-07
Sr-92	6.08E-12	6.00E-05	1.01E-07
Y-90	1.91E-13	2.00E-05	9.55E-09
Y-91	4.17E-12	3.00E-05	1.39E-07
Y-91m	1.91E-13	3.00E-03	6.37E-11
Y-92	1.20E-12	6.00E-05	2.00E-08
Y-93	2.61E-12	3.00E-05	8.68E-08
Zr-95	5.04E-12	6.00E-05	8.40E-08
Nb-95	5.04E-12	1.00E-04	5.04E-08
Mo-99	1.91E-12	4.00E-05	4.78E-08
Tc-99m	5.73E-09	3.00E-03	1.91E-06
Ru-103	3.82E-12	8.00E-05	4.78E-08
Ru-106	9.55E-13	1.00E-05	9.55E-08
Rh-103m	3.30E-13	1.00E-02	3.30E-11
Te-129m	7.64E-11	2.00E-05	3.82E-06
Te-129	5.91E-11	8.00E-04	7.38E-08
Te-131m	1.91E-10	4.00E-05	4.78E-06
Te-131	6.95E-11	3.00E-06	2.32E-05
Te-132	2.26E-09	2.00E-05	1.13E-04
Te-134	2.26E-10	3.00E-06	7.53E-05
I-131	2.08E-08	3.00E-07	6.95E-02
I-132	6.77E-09	8.00E-06	8.47E-04
I-133	3.30E-08	1.00E-06	3.30E-02
I-134	4.69E-09	2.00E-05	2.34E-04
I-135	1.91E-08	4.00E-06	4.78E-03
Cs-134	3.65E-09	9.00E-06	4.05E-04
Cs-136	1.32E-09	6.00E-05	2.20E-05
Cs-137	3.47E-09	2.00E-05	1.74E-04
Cs-138	2.61E-09	3.00E-06	8.69E-04
Ba-137m	7.12E-15	3.00E-06	2.37E-09
Ba-139	4.52E-12	3.00E-06	1.51E-06
Ba-140	3.13E-11	2.00E-05	1.56E-06

(a) Based on concentration in Waste Monitor Tank for design basis source term during normal operating conditions (See Table 12.2-17).

Table 11.2-5: Design Basis Average Daily Liquid Effluent Concentration (a)

Nuclide	$C_p(i)$ (μCi/ml)	MPC(i) (μCi/ml)	FMPC(i)
La-140	4.34E-12	2.00E-05	2.17E-07
Ce-141	4.86E-12	9.00E-05	5.40E-08
Ce-143	3.65E-12	4.00E-05	9.12E-08
Ce-144	3.65E-12	1.00E-05	3.65E-07
Pr-144	1.18E-13	3.00E-06	3.94E-08
Mn-54	5.56E-11	1.00E-04	5.56E-07
Co-58	1.60E-10	9.00E-05	1.78E-06
Co-60	1.91E-11	3.00E-05	6.37E-07
Fe-59	1.04E-11	5.00E-05	2.08E-07
Cr-51	1.08E-10	2.00E-03	5.38E-08
H-3	4.97E-04	3.00E-03	1.66E-01
		Total:	2.76E-01 MPC

(a) Based on the concentration in Waste Monitor Tank for the design basis source term during normal operating conditions (See Table 12.2-17).

Table 11.2-6: Normal Operating Average Daily Liquid Effluent Concentration (a)

Nuclide	$C_p(i)$ (µCi/ml)	MPC(i) (µCi/ml)	FMPC(i)
Sr-89	4.86E-15	3.00E-06	1.62E-09
Sr-90	4.17E-16	3.00E-07	1.39E-09
Sr-91	3.34E-14	7.00E-05	4.76E-10
Y-91	1.81E-16	3.00E-05	6.02E-12
Y-93	1.46E-13	3.00E-05	4.86E-09
Zr-95	1.35E-14	6.00E-05	2.26E-10
Nb-95	9.73E-15	1.00E-04	9.73E-11
Mo-99	2.22E-13	4.00E-05	5.56E-09
Tc-99m	1.63E-13	3.00E-03	5.44E-11
Ru-103	2.61E-13	8.00E-05	3.26E-09
Ru-106	3.13E-12	1.00E-05	3.13E-07
Ag-110m	4.52E-14	3.00E-05	1.51E-09
Te-129m	6.60E-15	2.00E-05	3.30E-10
Te-129	8.34E-13	8.00E-04	1.04E-09
Te-131m	5.21E-14	4.00E-05	1.30E-09
Te-131	2.67E-13	3.00E-06	8.92E-08
Te-132	5.91E-14	2.00E-05	2.95E-09
I-131	1.56E-11	3.00E-07	5.21E-05
I-132	7.30E-11	8.00E-06	9.12E-06
I-133	4.86E-11	1.00E-06	4.86E-05
I-135	9.03E-11	4.00E-06	2.26E-05
Cs-134	3.08E-10	9.00E-06	3.43E-05
Cs-136	3.78E-11	6.00E-05	6.30E-07
Cs-137	4.08E-10	2.00E-05	2.04E-05
Ba-140	4.52E-13	2.00E-05	2.26E-08
La-140	8.68E-13	2.00E-05	4.34E-08
Ce-141	5.21E-15	9.00E-05	5.79E-11
Ce-143	9.73E-14	4.00E-05	2.43E-09
Ce-144	1.35E-13	1.00E-05	1.35E-08
Na-24	1.63E-12	3.00E-05	5.44E-08
Cr-51	1.08E-13	2.00E-03	5.38E-11
Mn-54	5.56E-14	1.00E-04	5.56E-10
Fe-55	4.17E-14	8.00E-04	5.21E-11
Fe-59	1.04E-14	5.00E-05	2.08E-10
Co-58	1.60E-13	9.00E-05	1.78E-09
Co-60	1.84E-14	3.00E-05	6.14E-10
Zn-65	1.77E-14	1.00E-04	1.77E-10
W-187	8.69E-14	6.00E-05	1.45E-09
Np-239	7.64E-14	1.00E-04	7.64E-10
H-3	1.74E-04	3.00E-03	5.79E-02
		Total:	5.81E-02 MPC

(a) Based on the concentration in Waste Monitor Tank for the average normal operating source term (calculated utilizing NUREG-0017 methodology) during normal operating conditions.

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11.2 LIQUID WASTE MANAGEMENT SYSTEMS

11.2.1 DESIGN BASES

11.2.1.1 Criteria

The Liquid Waste Management System (LWMS) is designed to meet the the following criteria:

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A. The system must meet the regulatory design basis which is that it be capable of reducing releases of radioactive material in liquid effluents to as low as reasonably achievable in accordance with 10 CFR 50 Appendix I.

B. The system must contribute to meeting the performance design objectives in that it must never interfere with normal station operation including anticipated operational occurrences. E

C. The system must meet the safety design basis which is that the consequences of accidental releases from the LWMS must not exceed the Standards of Protection Against Radiation, 10 CFR 20.

D. The system must also contribute to meeting the occupational exposure design objective by keeping operation and maintenance exposure as low as reasonably achievable.

11.2.1.2 Codes and Standards

The LWMS is designed in accordance with the guidance of Regulatory Guide 1.143 and is designed to the codes and standards listed in Table 1 of Regulatory Guide 1.143.

Although the LWMS is not required to be designed as a Seismic Category I, it is surrounded by a curb, capable of retaining the entire contents of the Radwaste Building. The Radwaste Building foundation and curb are designed to the seismic criteria of regulatory position 5 of Regulatory Guide 1.143 and are designed to withstand or accommodate long-term settlement. I

11.2.1.3 Features

The following features assist in meeting the Design Criteria:

A. The system takes advantage of feed stream segregation to allow most efficient processing of waste. This permits large volumes of potential waste with little or no contamination to be monitored and released with minimal E I

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Insert B

11.2 LIQUID WASTE MANAGEMENT SYSTEMS

The design objectives of the Liquid Waste Management System (LWMS) is to protect the plant personnel, the general public, and the environment by providing a means to collect, segregate, store, process, sample, and monitor radioactive liquid waste. Each type of liquid waste is segregated to minimize the potential for mixing and contamination of non-radioactive flow streams. The processed liquid radioactive waste is sampled prior to release from Waste Monitor Tanks and radiation monitors are provided in the discharge line to provide for a controlled monitored release. The concentration of the liquid effluent at the potable water source released during normal operation, including anticipated operational occurrences, is below concentrations specified in 10 CFR 20 and meet the As Low As Reasonably Achievable (ALARA) criteria of 10 CFR 50, Appendix I.

11.2.1 DESIGN BASES

11.2.1.1 Criteria and Evaluation

The Liquid Waste Management System (LWMS) is designed in accordance with the acceptance criteria defined in the Standard Review Plan, Section 11.2. The design criteria are the following:

A. Effluents normally released to unrestricted areas must meet the limiting requirements of 10 CFR 20 and meet the ALARA objectives of 10 CFR 50, Appendix I.

 The LWMS intermittently discharges liquid effluent in batches to the environment. Table 11.2-1 provides an estimate of the annual liquid effluent releases (Ci/yr) based on results from PWR-GALE using NUREG-0017 methodology. Assumptions used to calculate the annual release rate are discussed in Section 11.2.6. This estimated annual release rate is used to calculate the estimated annual dose to the maximum individual. These results are listed in Table 11.2-4. This analysis assures that effluents during normal operation and anticipated operational occurrences meet 10 CFR 50, Appendix I objectives.

 The LWMS is designed to ensure that normal releases to unrestricted areas are within 10 CFR 20, Appendix B, Table II, Column 2 maximum permissible concentrations based on the design basis source term. Section 11.2.7 provides a detailed discussion regarding the methodology used to calculate the concentration of the effluent at the potable water source. The results of this analysis assure that the concentration of

Insert B (cont'd)

the liquid effluent at the potable water source are well within 10 CFR 20, Appendix B, Table II, Column 2 maximum permissible concentrations.

B. The system must contribute to meeting the performance design objectives in that it must never interfere with the normal station operation including anticipated operational occurrences.

The LWMS is a non-nuclear safety related system. It has no accident mitigation functions. The LWMS is designed in accordance with requirements in ANSI/ANS 55.2-1976 and Regulatory Guide 1.143. This includes the following features:

1. The LWMS is designed with sufficient redundancy to tolerate a single major component failure an process radioactive liquid waste during normal operation, including anticipated occurrences.

2. The LWMS is designed with sufficient storage capacity and redundancy to accommodate an increase in demand during normal operation of the plant.

C. Releases of radioactive materials to the environment must be controlled and monitored in accordance with 10 CFR 50, Appendix A (General Design Criteria 60, 61 and 64).

The release of liquid waste requires an operator action. Prior to release through the plant discharge, radioactive liquid waste is sampled. The LWMS is also provided with a radiation monitor which monitors in the discharge line downstream from the Waste Monitor Tanks. In the event that the concentration of the discharge may exceed 10 CFR 20 limits, the radiation monitor would terminate the discharge. Section 11.5, Radiation Monitoring System, provides a detailed discussion regarding the radiation monitoring for the LWMS.

D. Accidental releases of radioactive materials from a single component of the LWMS must not result in offsite doses which exceed the guidelines of 10 CFR 20.

The LWMS is housed in a structure designed in accordance with requirements specified in Regulatory Guide 1.143. The Radwaste Building provides a seismic containment facility or bathtub to contain the maximum inventory of liquid in the building. It is assumed that the Radwaste Building is physically connected to the Nuclear Annex. This assumption will be confirmed once a site is specified. Therefore, there

Insert B (cont'd)

is no liquid release to the environment due to a LWMS failure or leak. In addition, the LWMS is designed so that there is no possibility of gravity or syphon flow from the LWMS to the environment. This precludes an inadvertent release of radioactive liquid to the environment by this mechanism.

E. The system must also contribute to meeting the occupational exposure design objective by keeping operation and maintenance exposure ALARA.

The LWMS is designed in accordance with guidance provided in Regulatory Guide 8.8, ANSI/ANS-55.2-1976, and Regulatory Guide 1.143. This ensures that the LWMS will meet ALARA objectives.

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Each pair of Waste Monitor Tanks will also alternate as the receiver of the process stream. The one that is filling will have the mixer started above the low level permissive so that when the tank is full, a representative sample will be immediately available. The details of the effluent release are provided in Section 11.2.6.

11.2.3 SAFETY EVALUATION

The LWMS has no safe shutdown or accident mitigation function. ~~It is demonstrated in Chapter 15 that~~ Accidental releases ~~when evaluated on a conservative basis are not expected to~~ will not exceed the limits of 10 CFR 20. Accidental releases due to a major component failure or LWMS leak, will be contained in the Radwaste Building.

11.2.4 INSPECTION AND TESTING REQUIREMENTS

A program of testing requirements appropriate to assure that the LWMS is operating as intended is developed prior to fuel loading. Emphasis is placed on verifying remote function, and instrumentation important to the design objectives. Testing of the waste process streams for the most effective and economical process is required periodically during normal operation.

11.2.5 INSTRUMENTATION REQUIREMENTS

Instrumentation and indication important to the design basis of the LWMS are as follows:

A. Level Indicators

All Waste Collection and Waste Monitor Tanks are equipped with continuous level indicators. In addition, redundant means of detecting high level are provided along with non-redundant low level indicators. High level is alarmed both locally and in the LWMS control area. Levels in the area sumps and tanks which feed the LWMS Collection Tanks are also indicated in the LWMS control area.

B. Radioactive Liquid Effluent Monitor

Prior to release, waste liquid is held in a monitor tank from which a representative sample is taken. Inlet valves on tanks being prepared for release are closed, providing for a batch release. However, all releases are made through an effluent monitor. The effluent monitor set point is adjusted so that it will only alarm on unexpected high activity (relative to batch release sample information). The alarm also automatically terminates the release.

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11.3 GASEOUS WASTE MANAGEMENT SYSTEM

The design objectives of the Gaseous Waste Management System (GWMS) are to protect the plant personnel, the general public, and the environment by providing a means to collect, store, process, sample, and monitor radioactive gaseous waste. Airborne releases of radioactive material to the environment are well below concentrations specified in 10 CFR 20 and meet the As Low As Reasonably Achievable (ALARA) criteria of 10 CFR 50, Appendix I.

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11.3.1 DESIGN BASES

11.3.1.1 Criteria

The Gaseous Waste Management System (GWMS) is designed to meet the following criteria:

A. Effluents normally released to unrestricted areas must meet the limiting requirements of 10 CFR 20 and meet the ALARA objectives of 10 CFR 50, Appendix I.

B. The system must contribute to meeting the performance design objectives in that it must never interfere with normal station operation including anticipated operational occurrences.

C. Releases of radioactive materials to the environment must be controlled and monitored in accordance with 10 CFR 50, Appendix A (General Design Criteria 60 and 64). I

D. Accidental release of radioactive material from a single component of the GWMS must not result in offsite doses which exceed the guidelines of 10 CFR 20.

E. The system must also contribute to meeting the occupational exposure design objective by keeping operation and maintenance exposure ALARA.

11.3.1.2 Codes and Standards

The GWMS is designed in accordance with the guidance of Regulatory Guide 1.143 and is designed to the codes and standards listed in Table 1 of Regulatory Guide 1.143.

11.3.1.3 Features

The following features assist in meeting the Design Criteria:

A. High activity hydrogenated gaseous waste streams are processed through carbon adsorbers to retain and delay

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11.3.1 DESIGN BASES

11.3.1.1 Criteria and Evaluation

The GWMS is designed in accordance with the acceptance criteria defined in the Standard Review Plan, Section 11.3. The design criteria are the following:

A. Effluents normally released to unrestricted areas must meet the limiting requirements of 10 CFR 20 and meet the ALARA objectives of 10 CFR 50, Appendix I.

   The GWMS continuously discharges effluent. Table 11.3-4 provides an estimate of the annual airborne effluent releases (Ci/yr) based on results from PWR-GALE. Assumptions used to calculate the annual release rate are discussed in Section 11.3.6. This estimated annual release rate is used to calculate the estimated annual dose to the maximum individual. These results are listed in Table 11.3-5. This analysis assures that effluents during normal operation and anticipated operational occurrences meet 10 CFR 50, Appendix I objectives.

   The GWMS is designed to ensure that normal releases to unrestricted areas are within 10 CFR 20, Appendix B maximum permissible concentrations based on the design basis source term. Section 11.3.8 provides a detailed discussion regarding the methodology used to calculate the concentration of the effluent at the Exclusion Area Boundary. The results of this analysis assure that the concentration of the effluent are well within 10 CFR 20, Appendix B, Table II, Column 1 maximum permissible concentrations.

B. The system must contribute to meeting the performance design objectives in that it must never interfere with the normal station operation including anticipated operational occurrences.

   The GWMS is a non-nuclear safety related system. It has no accident mitigation functions. The GWMS is designed in accordance with requirements in ANSI/ANS 55.4-1979, Regulatory Guide 1.143 and 1.140. This includes the following features:

   . The GWMS is designed to preclude a buildup of an explosive mixture of hydrogen and oxygen which could impact the operation of the plant.

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Insert A (cont'd)

2. The GWMS is designed with sufficient storage capacity and redundancy to accommodate an increase in demand during normal operation of the plant.

C. Releases of radioactive materials to the environment must be controlled and monitored in accordance with 10 CFR 50, Appendix A (General Design Criteria 60, 61 and 64).

The GWMS is provided with radiation monitors which monitor the discharge from the charcoal adsorber beds upstream of the filter packages in the Radwaste Ventilation System. The GWMS discharge is automatically isolated if the discharge limit will be exceeded. Section 11.5, Radiation Monitoring System, provides a detailed discussion regarding the radiation monitoring for the GWMS.

D. Accidental releases of radioactive materials from a single component of the GWMS must not result in offsite doses which exceed the guidelines of 10 CFR 20.

Section 11.3.7 provides a discussion of the analysis of a single component failure of the GWMS. The methodology used in this analysis is in accordance with Branch Technical ESTB-11-5 for the design basis source term. The results of this analysis confirm that the dose consequence of a single failure of component in the GWMS is within the guidelines of 10 CFR 20.

E. The system must also contribute to meeting the occupational exposure design objective by keeping operation and maintenance exposure ALARA.

The GWMS is designed in accordance with guidance provided in Regulatory Guide 8.8, ANSI/ANS-55.4-1979, and Regulatory Guide 1.143 and 1.140. This ensures that the GWMS will meet ALARA objectives.

F. Protection will be provided to gaseous waste handling and treatment systems from the effects of an explosive mixture of hydrogen and oxygen in accordance with 10 CFR 50, Appendix A (General Design Criteria 3).

The GWMS is designed to preclude the buildup of an explosive mixture of hydrogen and oxygen in accordance with the Standard Review Plan, Section 11.3. Dual hydrogen analyzers are utilized to monitor the concentration of hydrogen and oxygen in the GWMS. Alarms are provided in the control room to alarm

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<u>Insert A (cont'd)</u>

on high hydrogen and oxygen concentration. The hydrogen and oxygen concentration will be maintained less than 4% by nitrogen purge.

11.3.7 GASEOUS WASTE MANAGEMENT SYSTEM LEAK OR FAILURE

11.3.7.1 Identification of Causes and Accident Description

The Gaseous Waste Management System (GWMS), as discussed in Section 11.3 is designed to collect, monitor, and store radioactive waste gases which originate in the reactor coolant system and require processing by holdup for decay prior to release. The GWMS utilizes ambient temperature charcoal adsorption beds to provide sufficient decay of noble gases.

The accident is defined as an unexpected and uncontrolled release of radioactive Xenon and Krypton gases from the GWMS resulting from an inadvertent bypass of the main decay portion of the charcoal adsorption beds. It is assumed to take as long as 2 hours to isolate or terminate the release.

11.3.7.2 Analysis of Effects and Consequences

The release source term is conservatively calculated based on the methodology given by Branch Technical Position ETSB 11-5. In the absence of site specific meteorological data and site Exclusion Area Boundary (EAB) information, an atmospheric diffusion factor of 4.97×10^{-4} s/m^3 was assumed for a 2 hour release.

The resulting EAB noble gas dose is 14.7 mrem to the whole body which meets the guidelines of the Standard Review Plan. I

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11.3.8 Concentration of Normal Effluents

The Gaseous Waste Management System (GWMS) processes gaseous waste through a charcoal delay system which holds up noble gases and allows them to decay prior to release. The concentration at the exclusion area boundary during normal operation, including anticipated operating occurrences, was analyzed to verify it is less than 10 CFR 20, Appendix B, Table II, Column 1.

11.3.8.1 Analysis of Effects and Consequences

A. Bases

The bases for the estimated concentration of effluent are as follows:

1. This system continuously discharges at a uniform rate.

2. The concentration of the effluent is based on the design basis source term.

3. The total gaseous effluent calculated using NUREG-0017 methodology shown in Table 11.3-4 is multiplied by seven to yield a conservative approximation of the design basis source term. This methodology is consistent with the suggested methodology in Branch Technical Position ESTB 11-5 for a Waste Gas System Leak of Failure consequence analysis.

4. In the absence of site specific meteorological data and site Exclusion Area Boundary (EAB) information, an atmospheric dispersion factor of 4.97×10^{-4} s/m^3 was assumed for the EAB (500 meters) based on Chapter 15, Appendix A.

B. Methodology

The methodology used to calculate the concentration of the effluent at the Exclusion Area Boundary is as follows:

$$C(i) = CF * 7R(i) * X/Q_{EAB}$$

Where:

C(i) = Concentration of the i^{th} isotope at the EAB

(μCi/ml)

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CF ≡ Conversion Factor
= 3.17×10^{-11} (s-μCi-m^3/yr-Ci-ml)

R(i) ≡ Release Rate of i^{th} isotope (Ci/yr)

X/Q_{EAB} = Atmospheric dispersion factor at EAB (s/m^3)
= 4.97×10^{-4} (s/m^3)

C. Results and Conclusions

The concentration of the effluent at the Exclusion Area Boundary is shown in Table 11.3-5. The concentration at the Exclusion Area Boundary is well within 10 CFR 20 guidelines. Although there are periodic purges of containment during normal operation, these purges will be controlled by precedures developed by the Owner Operator to ensure compliance with 10 CFR 20 limits.

Table 11.3-5: Average Annual Concentration of Gaseous Effluents at the Exclusion Area Boundary (a)

Nuclide	C(i) (uCi/ml)	MPC(i) (uCi/ml)	FMPC(i)
I-131	1.98E-15	1.00E-10	1.98E-05
I-133	5.95E-15	4.00E-10	1.49E-05
Kr-85M	4.41E-13	1.00E-07	4.41E-06
Kr-85	8.49E-11	3.00E-07	2.83E-04
Kr-87	4.41E-13	2.00E-08	2.20E-05
Kr-88	8.82E-13	2.00E-08	4.41E-05
Xe-131M	1.76E-11	4.00E-07	4.41E-05
Xe-133M	1.10E-13	3.00E-07	3.67E-07
Xe-133	7.83E-12	3.00E-07	2.61E-05
Xe-135M	4.41E-13	3.00E-08	1.47E-05
Xe-135	2.65E-12	1.00E-07	2.65E-05
Xe-138	4.41E-13	3.00E-08	1.47E-05
Cr-51	3.64E-18	8.00E-08	4.55E-11
Mn-54	2.20E-18	1.00E-09	2.20E-09
Co-57	2.65E-19	6.00E-09	4.41E-11
Co-58	3.31E-17	2.00E-09	1.65E-08
Co-60	1.06E-17	3.00E-10	3.53E-08
Fe-59	9.48E-19	2.00E-09	4.74E-10
Sr-89	7.83E-18	3.00E-10	2.61E-08
Sr-90	3.09E-18	3.00E-11	1.03E-07
Zr-95	1.21E-18	1.00E-09	1.21E-09
Nb-95	3.31E-18	3.00E-09	1.10E-09
Ru-103	6.17E-19	3.00E-09	2.06E-10
Ru-106	1.10E-19	2.00E-10	5.51E-10
Sb-125	6.72E-20	9.00E-10	7.47E-11
Cs-134	3.64E-18	4.00E-10	9.10E-09
Cs-136	1.10E-18	6.00E-09	1.84E-10
Cs-137	6.39E-18	5.00E-10	1.28E-08
Ba-140	6.95E-19	1.00E-09	6.95E-10
Ce-141	4.74E-19	5.00E-09	9.48E-11
H-3	1.32E-10	4.00E-05	6.61E-04
C-14	8.05E-13	1.00E-07	8.05E-06
Ar-41	3.75E-12	4.00E-08	9.37E-05
		Total:	1.28E-03 MPC

(a) Based on the design basis source term.

Insert C →

11.3.7 GASEOUS WASTE MANAGEMENT SYSTEM LEAK OR FAILURE

11.3.7.1 Identification of Causes and Accident Description

The Gaseous Waste Management System (GWMS), as discussed in Section 11.3 is designed to collect, monitor, and store radioactive waste gases which originate in the reactor coolant system and require processing by holdup for decay prior to release. The GWMS utilizes ambient temperature charcoal adsorption beds to provide sufficient decay of noble gases.

The accident is defined as an unexpected and uncontrolled release of radioactive Xenon and Krypton gases from the GWMS resulting from an inadvertent bypass of the main decay portion of the charcoal adsorption beds. It is assumed to take as long as 2 hours to isolate or terminate the release.

11.3.7.2 Analysis of Effects and Consequences

The release source term is conservatively calculated based on the methodology given by Branch Technical Position ETSB 11-5. In the absence of site specific meteorological data and site Exclusion Area Boundary (EAB) information, an atmospheric diffusion factor of 4.97×10^{-4} s/m^3 was assumed for a 2 hour release.

The resulting EAB noble gas dose is 14.7 mrem to the whole body which meets the guidelines of the Standard Review Plan. I

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11.3.7 GASEOUS WASTE MANAGEMENT SYSTEM LEAK OR FAILURE

11.3.7.1 Identification of Causes and Accident Description

The Gaseous Waste Management System (GWMS), as discussed in section 11.3 designed to collect, monitor, and store radioactive waste gases which originate in the reactor coolant system and require processing by holdup for decay prior to release. The GWMS utilizes ambient temperature charcoal adsorption beds to provide sufficient decay of noble gases.

The accident is described as an unexpected and uncontrolled release of radioactive Xenon and Krypton gases from the GWMS resulting from an inadvertent bypass of the main decay portion of the charcoal adsorber beds. It is assumed to take as long as 2 hours to isolate or terminate the release.

11.3.7.2 Analysis of Effects and Consequences

A. Bases

1. The assumptions and methodology are consistent with guidance provided in Branch Technical Position ESTB 11-5.

2. An effective holdup time of 30 minutes is assumed for the bypass flow to account for transport time of the gases through the GWMS components via the release point to the nearest exclusion area boundary.

3. In accordance with ESTB 11-5, the Waste Gas System maximum design capacity source term (at sustained power) is assumed to seven times the source term considered for normal operation, including anticipated operational occurrences. PWR-GALE is run for a 30 minute decay case and the results are multiplied by seven to calculate the maximum design capacity source term.

4. The total source term is equal to the maximum design basis source term plus the normal operations source term shown in Table 11.3-4.

5. Particulates and radioiodines are assumed to be removed by pretreatment, gas separation, and intermediate radwaste treatment equipment. Therefore, only the whole body dose is calculated in this analysis.

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6. In the absence of site specific meteorological data and exclusion area boundary information, an atmospheric dispersion factor (X/Q) is assumed for the exclusion area boundary as described in Chapter 15, Appendix A.

B. Methodology

To calculate the dose consequences for a Waste Gas System failure methodology consistent with Branch Technical ESTB 11-5 is used.

$$D = \sum K(i) * Q(i) * X/Q * 7.25$$

Where:

D = Dose (mrem)

K(i) = the total-body dose factor given in Table B-1 of Regulatory Guide 1.109 for the i^{th} isotope (mrem-m^3/pCi/yr)

Q(i) = the noble gas nuclide release rate for the i^{th} isotope (Ci/yr)

X/Q = atmospheric dispersion factor at the exclusion area boundary

X/Q = 4.97×10^{-4} s/m^3

7.25 = conversion factor for 2 hour release (pCi-yr^2/Ci-event-sec)

C. Results and Conclusions

The resulting Exclusion Area Boundary noble gas dose to the whole body is 14.7 mrem. This meets the guidelines specified in the Standard Review Plan Section 11.3.

Question 410.138

a. General: The design of the Solid Waste Management System, as it appears in the CESSAR, is in a conceptual stage. It does not include the detail necessary to conduct a thorough review in accordance with the requirements of SRP Section 11.4. For design certification, the CESSAR is expected to contain the type and depth of information delineated in SRP Section 11.4, Part I, Items 1 through 9.

b. The design criteria for the SWMS should also include: GDC 60 as it relates to the radioactive waste management systems being designed to control releases of radioactive materials to the environment; GDC 63 and 64 as they relate to the radioactive waste systems being designed for monitoring radiation levels and leakage; 10 CFR Part 71 as it relates to radioactive material packaging; and 10 CFR 20.106 as it relates to radioactivity in effluents to unrestricted areas. Include these criteria in the design basis and address them in the design evaluation section.

c. Provide P&ID drawings for the SWMS.

d. Provide the specific design features and codes and standards where the design follows the guidance of Regulatory Guide 1.143.

e. Section 11.4.3, feature A, discusses provisions in the design to accommodate leased equipment. Explain how this feature assists in meeting the design criteria stated in section 11.4.1.1.

f. Discuss how the design meets all relevant guideline requirements of Branch Technical Position ETSB 11-3 attached to SPO Section 11.4.

g. Section 11.4.4.states that "...accidental releases from this system, when evaluated on a conservative basis, will not exceed the limits of 10 CFR 20." Provide the bases for this assessment; i.e., What is the conservative basis? What kind of an accident was considered? How was it analyzed? Provide the results of the analysis (consequences) and compare to the 10 CFR Part 20 limits which are referred to in the section.

Response 410.138

a. The issue is considered to be a question of level-of-detail necessary for design certification. The detailed design of the liquid, gaseous, and solid waste management system will depend on vendor supplied information, radwaste process technology at the time of detailed design and site specific parameters, such as dilution flow, X/Q dispersion factors, and local requirements for disposal sites. Adequate information has been provided through design criteria and evaluations, required features, process flow diagrams, system descriptions, system operation descriptions, inspection and testing requirements, instrumentation requirements and release analysis, including estimated quantity of radioactivity released, sources, estimated volumes, and activity levels, and volumes of inputs, to make a licensing determination for design certification. The licensing requirements contained in CESSAR-DC will be verified throughout the detailed design and construction of the waste management systems through inspection, test, analysis and acceptance criteria (ITAAC) and 10 CFR 50.59 evaluations.

b. Section 11.4 of CESSAR-DC will be revised to incorporate the above criteria (General Design Criteria: 60, 61, 63, 64, 10 CFR 20 and 71), as well as the associated design basis evaluation. A copy of this future revision is attached for NRC review.

c. Process flow diagrams for the Solid Waste Management System are provided in CESSAR-DC Figure 11.4-1. Detailed P&ID drawings require procurement-level information, developed during the final design process, which is not considered necessary at this time considering the minor safety significance of this system..

d. Section 11.4 will be updated to include a discussion regarding the specific design features which meet criteria specified in Regulatory Guide 1.143. A copy of this future addition is attached for NRC review.

e. This feature provides additional flexibility for the Solid Waste Management System accommodate increased processing requirements or single major equipment failure.

f. The Solid Waste Management System design will be designed in accordance with guidance provided in Branch Technical Position ETSB 11-3.

g. The Radwaste Building, which will house the Solid Waste Management System (SWMS), will be designed in accordance with the requirements per Regulatory Guide 1.143. Regulatory Guide 1.143 does not require a dose consequence analysis since the liquid released due to a SWMS failure would be retained in the Radwaste Building.

Therefore, no analysis will be performed for an effluent release.

Insert A →

11.4 SOLID WASTE MANAGEMENT SYSTEM

Superceded By Insert A

11.4.1 DESIGN BASES

11.4.1.1 Criteria

The Solid Waste Management System (SWMS) is designed to meet the following criteria.

A. The system must contribute to meeting the performance design objectives in that it must never interfere with normal station operation including anticipated operational occurrences.

B. The system must also contribute to meeting the occupational exposure design objective by keeping operation and maintenance exposure as low as reasonably achievable (ALARA).

C. The system must produce a packaged waste from suitable for shipment to and acceptance at a licensed burial facility. E

11.4.1.2 Codes and Standards

The SWMS is designed under the general guidance of Regulatory Guide 1.143, and to the codes and standards listed in Table 1 of of Regulatory Guide 1.143.

Although the SWMS is not required to be designed as Seismic Category I, it is surrounded by a curb, capable of retaining the entire liquid contents of the Radwaste Building. The foundation and surrounding curb are designed to withstand or accommodate long-term settlement.

11.4.1.3 Features

The following features assist in meeting the design criteria.

A. The system has provisions to accommodate leased equipment which may provide the most economical choice at particular times or for particular waste.

B. Many normal system operations are remotely controlled from a centralized control panel which permits operators to most effectively coordinate activities.

C. Active and replaceable components have crane access to facilitate removal and repair.

410.138(b)

Insert A

11.4 SOLID WASTE MANAGEMENT SYSTEM

The Solid Waste Management System (SWMS) is designed to protect the plant personnel, the general public, and the environment by providing a means to collect, segregate, store, process, sample, and monitor solid waste. The SWMS processes both wet solid waste and dry active waste for shipment to a licensed burial site.

11.4.1 DESIGN BASES

11.4.1.1 Criteria and Evaluation

The SWMS is designed in accordance with the following Standard Review Plan Section 11.4 acceptance criteria:

A. Releases of radioactive materials to the environment must be controlled and monitored in accordance with 10 CFR 50, Appendix A (General Design Criteria 60 and 64).

The SWMS is designed so that liquids removed during the dewatering process of wet solid waste are routed back to the Liquid Waste Management System (LWMS) to be processed prior to release to the environment. Non-clogging sire screens, such as Johnson screens, are provided on the Resin Storage Tanks and shipping containers to prevent an inadvertent discharge of resin beads to environment via the LWMS.

The gases collected in the dry active waste processing area are discharged via the Radwaste Building Ventilation System to the unit vent. The dry solids compactor is provided with an air filtration system which includes a HEPA filter. A fan draws air through the HEPA filter and exhausts gases, generated by compaction, through the Radwaste Building Ventilation System where the exhaust is filtered prior to release to the environment. This filtration system prevents a possible unfiltered release of airborne contamination to the environment.

Both of the above discharge paths are provided with monitors discussed in detail in Section 11.5.

B. Effluents normally released to unrestricted areas must meet the limiting requirements of 10 CFR 20.

The liquid and gaseous effluents released during normal operation and anticipated operational occurrences to unrestricted areas are released through the LWMS and the

Insert A (cont'd)

Radwaste Building Ventilation System, respectively. Section 11.2 provides a detailed discussion confirming compliance with 10 CFR 20 for releases from the LWMS to the environment. In addition, Section 11.3 provides an estimate of the releases from the Gaseous Waste Management System, based on NUREG-0017 methodology, which includes the contribution from the Radwaste Building Ventilation System.

C. The system must contribute to meeting the performance design objectives in that it must never interfere with the normal station operation including anticipated normal operation.

The SWMS is designed in accordance with Regulatory Guide 1.143. The Radwaste Building provides a seismic retention basin to contain the contents of the building in the event of a major component failure. In addition, curbing is provided around major components such as the Resin Storage Tanks to contain their contents in the event of a failure.

The SWMS is designed with sufficient storage and surge capacity to accommodate the maximum anticipated input. Additional space is also reserved for storage of leased equipment to accommodate modifications to the SWMS as new processes and configurations become available.

D. The system must also contribute to meeting occupational exposure design objectives by keeping operation and maintenance exposure as low as reasonably achievable (ALARA.

Adequate spacing and cranes facilitate maintenance of SWMS components which reduces time required to perform maintenance activities. Normal system operations are remotely controlled from centralized control panel. This allows operators to perform operations tasks in a lower radiation area. Video monitors will also be used in SWMS processing and packaging areas which will reduce personnel exposure. Shielding of shipping containers will be evaluated and provided as necessary.

E. The system must produce a packaged waste which is suitable for shipment to and acceptance at a licensed burial facility.

Samples, taken from the spent resin storage tanks, will be used to classify the waste prior to disposal. All solid waste material which is shipped from the plant site to a licensed burial site is packaged in accordance with 10 CFR 71 and the Department of Transportation Regulations.

410.138(b)

Insert A (cont'd)

F. The packaged waste produced by the SWMS shall be classified and processed in accordance with 10 CFR 61 requirements.

The solid waste shall be disposed and processed in accordance with 10 CFR 61 requirements. Operating procedures will be developed by the Owner Operator. These procedures will provide boundary conditions for a set of process parameters (such as settling times, drain time, drying time, etc.) to assure that 10 CFR 61 requirements are met. In addition, resin storage tanks and shipping containers will be sampled and/or surveyed to verify that the solidification or dewatering process is complete in accordance with guidance from Branch Technical Position ETSB 11-3.

G. The SWMS is designed to ensure that the consequences of an accidental release are within 10 CFR 20 limits.

In the event of a major component failure of the SWMS, the contents would be contained within the Radwaste Building Structure. The Radwaste Building is designed in accordance with Regulatory Guide 1.143. The Radwaste Building will provide a seismic retention basin. Liquids released from the component will be collected and routed to the LWMS for processing. Any gaseous releases would be released to the Radwaste Building and discharged through filters to the environment via the Radwaste Building Ventilation System. Therefore, there will be no uncontrolled liquid or gaseous release to the environment.

It is assumed that the Radwaste Building is physically connected to the Nuclear Annex. This assumption will be confirmed once a site is specified.

Miscellaneous solid wastes such a rags, contaminated clothing, sweepings, and other equipment are compressed into containers with a mechanical compactor. During compactor operation, a fan is used to pull air through a HEPA filter and to a filtered exhaust system. When the containers are full they are manually sealed and moved to the low-level waste storage area to await shipment. Surveys of the containers are made prior to shipment.

Space is provided in the shielded storage area to accommodate large volumes of waste such as irradiated hardware or other off normal volumes of waste which may result from plant modification work. These wastes are generally not compacted, but placed directly into shielded, disposal containers.

11.4.3 EXPECTED WASTE VOLUMES

Table 11.4-2 lists the estimated annual solid waste volumes that will be shipped for disposal.

11.4.4 SAFETY EVALUATION

The SWMS has no safe shutdown or accident mitigation function. Finally, accidental releases from this system~~, when evaluated on a conservative basis,~~ will not exceed the limits of 10 CFR 20. Accidental releases due a major component failure or SWMS leak will be contained in the Radwaste Building.

11.4.5 INSPECTION AND TESTING REQUIREMENTS

A Process Control Program appropriate to assure that the SWMS is operating as intended is developed prior to fuel loading. Procedures for each phase of system operation including resin transfer and batching help ensure that design objectives are met. Emphasis is placed on verifying instrum[illegible]ation and remote functions important to these design objecti[illegible]. I

11.4.6 INSTRUMENTATION REQUIREMENTS

Instrumentation and indications important to the Design Basis of the SWMS are as follows:

A. Level Indicators

High level indication will be provided to prevent overflow of tanks during fill and resin transfer/sluice operations. These indications will be read in the facility control room. Also, video observation of all fill processes is included.

Densitometers are provided on the spent resin storage tanks and used to verify correct resin-to-water ratio when a batch of bead resin is to be solidified.

11.4 SOLID WASTE MANAGEMENT SYSTEM

11.4.1 DESIGN BASES

11.4.1.1 Criteria

The Solid Waste Management System (SWMS) is designed to meet the following criteria.

A. The system must contribute to meeting the performance design objectives in that it must never interfere with normal station operation including anticipated operational occurrences.

B. The system must also contribute to meeting the occupational exposure design objective by keeping operation and maintenance exposure as low as reasonably achievable (ALARA).

C. The system must produce a packaged waste from suitable for shipment to and acceptance at a licensed burial facility. E

11.4.1.2 Codes and Standards

The SWMS is designed under the general guidance of Regulatory Guide 1.143, and to the codes and standards listed in Table 1 of of Regulatory Guide 1.143.

Although the SWMS is not required to be designed as Seismic Category I, it is surrounded by a curb, capable of retaining the entire liquid contents of the Radwaste Building. The foundation and surrounding curb are designed to withstand or accommodate long-term settlement.

Insert B →

11.4.1.3 Features

The following features assist in meeting the design criteria.

A. The system has provisions to accommodate leased equipment which may provide the most economical choice at particular times or for particular waste.

B. Many normal system operations are remotely controlled from a centralized control panel which permits operators to most effectively coordinate activities.

C. Active and replaceable components have crane access to facilitate removal and repair.

410.138(d)

Insert B

The Radwaste Building is designed in accordance with Regulatory Guide 1.143 guidelines which include:

- Foundations and adjacent wall of structures that house the Solid Waste Management System is designed to withstand an Operating Basis Earthquake (OBE) to a height sufficient to contain the maximum liquid inventory expected to be in the building in accordance with C.3.1.3 and C.5.2,
- Indoor tanks are provided with curbing or elevated thresholds with floor drains routed back to the Liquid Waste Management System in accordance with Position C.1.2.3,
- All indoor tanks containing radioactive liquids are provided with level indication in accordance with Position C.1.2.1,
- Materials used for piping for radwaste systems are compatible with the chemical, physical, and radiation environment expected under normal and operational occurrences in accordance with Position C.3.1.2.

Question 410.135

e. This section needs to make differentiation between design basis failed fuel rate, coolant concentrations, etc. for the source term used for the design of the waste management systems, compliance with 10 CFR Part 20, and one time accidental releases, and the NUREG-0017, .12%, "expected" failed fuel rate for the source term used to satisfy 10 CFR 50 Appendix I, to meet the "as low as reasonably achievable" criterion.

Response 410.135

e. CESSAR-DC Section 11.1 will be revised to provide differentiation between "expected" and design basis "maximum" source terms used in the various plant routine release, shielding and accident design calculations.

Section 11.1 is revised as follows:

11.1 SOURCE TERMS

The average quantity of radioactive material released to the environment during normal operation including anticipated operational occurrences is calculated using PWR-GALE Code (Reference 1) and is based on guidance provided in NUREG-0017 (Reference 2). The adequacy of radioactive waste management systems is demonstrated by verifying compliance with 10 CFR 50, Appendix I offsite radiological release objectives using the NUREG-0017 "expected" source term basis.

Design basis "maximum" source terms are used in plant radiation shielding design and accidental offsite release evaluations. The use of design basis "maximum" source terms in shielding and accident calculations allows for short-term increases in reactor coolant concentration above the NUREG-0017 "expected" average concentrations. Design basis "maximum" source terms are addressed in Chapter 12.

The adequacy of radioactive waste management systems is also demonstrated by verifying compliance with the instantaneous offsite release rate and concentration limits of 10 CFR 20. Both "expected" and "maximum" source terms are used to demonstrate compliance with 10 CFR 20 radiological protection criteria. The "expected" source terms are used to demonstrate the long-term operational adequacy of radi[illegible]tive waste management systems. The ability to mai[illegible] liquid and airborne radionuclide concentrations b[illegible]0 CFR 20 instantaneous limits under short-term "max[illegible] source term conditions is also addressed.

Replace with INSERT 410.135.e.1

11.0 RADIOACTIVE WASTE MANAGEMENT

11.1 SOURCE TERMS

The average quantity of radioactive material released to the environment during normal operation, including anticipated operational occurrences is calculated using the PWR-GALE Code (Reference 1) and is based on guidance provided in NUREG-0017 (Reference 2).

11.1.1 ANTICIPATED PRIMARY COOLANT CONCENTRATIONS

Reactor Coolant System (RCS) radionuclide activity concentration source terms for normal reactor operating conditions, including anticipated operational occurrences, are developed as a basis for a) calculating routine radioactive releases in station effluents, b) calculating radionuclide concentrations in radioactive waste management and other plant systems during normal operation, and c) ensuring that occupational radiation exposures are as low as reasonably achievable (ALARA). A description of reactor coolant and plant system radiation sources used as the basis for shield design calculations is provided in Section 12.2.

11.1.1.1 Fission Product Activities

The concentrations of radioactive fission product isotopes in primary coolant under normal reactor operating conditions are calculated by methods developed in NUREG-0017. The parameters used in the coolant fission product source term calculations are summarized in Table 11.1.1-1. The calculated RCS fission product activity concentrations are summarized in Table 11.1.1-2. I

11.1.1.2 Corrosion and Activati.. Products

The concentrations of radioactive corrosion and activation products in primary coolant under normal reactor operating conditions (i.e., Na-24, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Zn-65, W-187 and Np-239) are included in Table 11.1.1-2. Corrosion and activation product concentrations are calculated by methods developed in NUREG-0017.

11.1.1.3 Tritium Production in Reactor Coolant

The principal sources of tritium production in a pressurized water reactor (PWR) are from ternary fission and neutron induced reactions in boron, lithium and deuterium that are present in the coolant, borated shim rods and Control Element Assemblies (CEAs). The tritium produced in the coolant contributes immediately to the overall tritium activity while the tritium produced by

CESSAR-DC SECTION 11.1 INSERT - RAI 410.135.e

INSERT 410.135.e.1

The average quantity of radioactive material released to the environment during normal operation including anticipated operational occurrences is calculated using PWR-GALE Code (Reference 1) and is based on guidance provided in NUREG-0017 (Reference 2). The adequacy of radioactive waste management systems is demonstrated by verifying compliance with 10 CFR 50, Appendix I offsite radiological release objectives using the NUREG-0017 "expected" source term basis.

Design basis "maximum" source terms are used in plant radiation shielding design and accidental offsite release evaluations. The use of design basis "maximum" source terms in shielding and accident calculations allows for short-term increases in reactor coolant concentration above the NUREG-0017 "expected" average concentrations. Design basis "maximum" source terms are addressed in Chapter 12.

The adequacy of radioactive waste management systems is also demonstrated by verifying compliance with the instantaneous offsite release rate and concentration limits of 10 CFR 20. Both "expected" and "maximum" source terms are used to demonstrate compliance with 10 CFR 20 radiological protection criteria. The "expected" source terms are used to demonstrate the long-term operational adequacy of radioactive waste management systems. The ability to maintain liquid and airborne radionuclide concentrations below 10 CFR 20 instantaneous limits under short-term "maximum" source term conditions is also addressed.

Question 410.135

f. Section 11.1.1.3.3 states that a maximum value of 2.5 microcurie/gram is maintained to limit in-plant airborne concentrations of tritium to within acceptable levels. Describe how the tritium concentration is controlled. Provide the assumptions, methodology and analysis performed to determine the average and maximum levels of tritium concertrations. Is the shim bleed rate value of 830 gpd, stated in the section, a typographical error?

Response 410.135

f. In-plant airborne tritium is controlled by limiting tritium concentration in the Reactor Coolant System (RCS). RCS tritium concentration is limited by minimizing tritium production during power operation (e.g., use of high quality, low clad failure rate fuel elements and enriched lithium for reactor coolant chemistry control) and by discharge from the plant. Surface water and atmospheric discharge of tritium are the most practical alternatives available for controlling reactor coolant tritium levels (i.e., ALARA) since isotopic separation is not currently economical and offsite radiological impacts associated with tritium releases are small.

Reactor Building (RB) airborne tritium concentration is limited below the 2.5 μCi/gm maximum value to permit short-term access during power operation. This value is established to allow at least 2 hours of occupational exposure per week without the use of protective breathing apparatus under most RB temperature and humidity conditions (assuming only reactor coolant leakage inside RB and no RB purge - see Figure 1).

The ability to maintain in-plant tritiated water concentrations less than the design basis maximum and average concentrations is demonstrated by comparing the sum of tritium losses from the plant (annual average tritium activity accounted for as releases to surface waters and the atmosphere calculated using NUREG-0017/PWR-GALE methodology plus the annual decay of tritium in tritiated water sources) to the maximum and average tritium activity production rates.

TRITIUM INVENTORY BALANCE EQUATION:

PRODUCTION = RELEASE + DECAY

Where:

PRODUCTION = Total H^3 production in reactor coolant (Ci/yr)

= CESSAR Table 11.1.1-5, Amendment I

RELEASE = Total H^3 accounted for as released in liquid and gaseous effluents as calculated using PWR-GALE (Ci/yr)

= CESSAR Tables 11.2.6-1 and 11.3.6-1, Amendment I

DECAY = H^3 activity decay rate in tritiated water (Ci/yr)

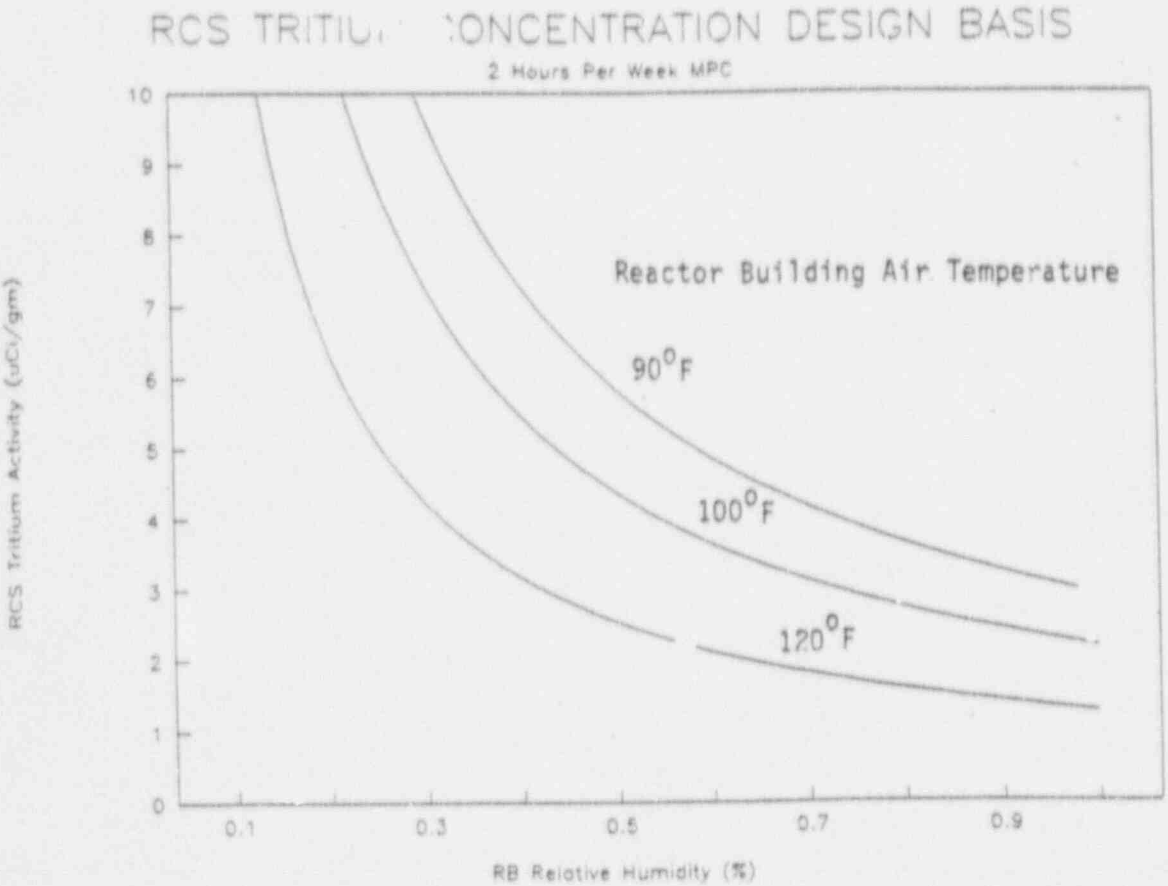
= 5.6 % Plant Inventory/yr

For both the maximum and average tritium production cases, total tritium production (1452 and 1211 Ci/yr, respectively) does not exceed the total liquid and airborne releases accounted for in the CESSAR Section 11.2 and 11.3 offsite radiological impact evaluations (1560 Ci/yr) plus decay (280 Ci/yr - based on an average tritiated water concentration of 1 μCi/gm and a total tritiated water inventory of 5.0E+09 gms). The conclusion of this comparison is that RCS coolant concentrations will likely remain below both design basis maximum and average tritium concentration levels and that annual average environmental releases will likely be lower than calculated using NUREG-0017/PWR-GALE methodology.

Reduced levels of tritium in the RCS and environmental effluents are expected benefits of higher levels of fuel performance and the specification of enriched lithium for RCS coolant chemistry control. Both of these measures help to reduce tritium production during power operation below historical levels experienced at operating PWRs (on which NUREG-0017/PWR-GALE methodology is based). Plant operational procedures shall include provisions for controlled discharges of RCS water (following processing in the Liquid Waste Management System) as necessary to maintain the RCS tritium concentration below 2.5 μCi/gm. RCS discharges related to tritium control are conservatively accounted for as an average 183 GPD surface water release rate in CESSAR Section 11.2 (see CESSAR Table 11.2.6-2, Amendment I, under "SHIM BLEED"). The 830 GPD value for average primary system bleed rate referenced in the question is a typographical error which has been subsequently corrected in CESSAR Section 11.1.1.3.3, Amendment I.

RAI 410.135 (f)

Figure 1



INSERT 410.135.f.1

11.1.1.3.3 Tritium Concentration

A tritium concentration of 1 microCi/gm in the reactor coolant is assumed as an average value over the life of the plant, although the instantaneous value may vary considerably due to feed and bleed operations or reactor coolant leakage. A maximum value of 2.5 μCi/gm is maintained to limit in-plant airborne concentrations of tritium to within acceptable levels. If concentrations increase above 2.5 μCi/gm, reactor coolant may be processed and released through the Chemical and Volume Control System (see Section 9.3.4) for tritium control.

Assuming a station tritiated water inventory of 5.0E9 gms (see Table 11.1.1-7) and the tritium production rates summarized in Table 11.1.1-5, an average primary system bleed rate of 183 GPD to the Liquid Waste Management System (see Section 11.2.6) will be sufficient to maintain reactor coolant tritium concentrations below the assumed average and maximum levels. I

Add "INSERT 410.135.f.2" to begin this ¶.

CESSAR-DC SECTION 11.1.1.3.3 INSERTS - RAI 410.135.f

INSERT 410.135.f.1

In-plant airborne tritium is controlled by limiting tritium concentration in the Reactor Coolant System (RCS). RCS tritium concentration is limited by minimizing tritium production during power operation (e.g., use of high quality, low clad failure rate fuel elements and enriched lithium for reactor coolant chemistry control) and by discharge from the plant. Surface water and atmospheric discharge of tritium are the most practical alternatives available for controlling reactor coolant tritium levels (i.e., ALARA) since isotopic separation is not currently economical and offsite radiological impacts associated with tritium releases are small.

RCS tritium concentration is limited below the 2.5 μCi/gm maximum value to permit short-term access to the Reactor Building (RB) during power operation. This value is established to allow at least 2 hours of occupational exposure per week without the use of protective breathing apparatus under most RB temperature and humidity conditions.

INSERT 410.135.f.2

The ability to maintain in-plant tritiated water concentrations less than the design basis maximum and average concentrations is demonstrated by comparing the sum of tritium losses from the plant (annual average tritium activity accounted for as releases to surface waters and the atmosphere calculated using NUREG-0017 methodology plus the annual decay of tritium in tritiated water sources) to the maximum and average tritium activity production rates provided in Table 11.1.1-5. For both the maximum and average tritium production cases, total tritium production (1452 and 1211 Ci/yr, respectively) does not exceed the total liquid and airborne releases accounted for in the Section 11.2 and 11.3 offsite radiological impact evaluations (1560 Ci/yr) plus decay (280 Ci/yr - based on an average tritiated water concentration of 1 μCi/gm and a total tritiated water inventory of 5.0E+09 gms). The conclusion of this comparison is that RCS coolant concentrations will likely remain below both design basis maximum and average tritium concentration levels and that annual average environmental releases will likely be lower than calculated using NUREG-0017 methodology.

Reduced levels of tritium in the RCS and environmental effluents are expected benefits of higher levels of fuel performance and the specification of enriched lithium for RCS coolant chemistry control. Both of these measures help to reduce tritium production during power operation below historical levels experienced at operating PWRs (on which NUREG-0017 methodology is based). Plant operational procedures shall include provisions for controlled discharges of RCS water (following processing in the Liquid Waste Management System) as necessary to control RCS tritium levels.

Question 410.139

a. The design of the process and effluent radiological monitoring and sampling systems, as it appears in the CESSA , is in a conceptual stage. It does not contain the detail necessary to conduct a thorough review in accordance with the requirements of SRP Section 11.5. For design certification, the CESSAR is expected to contain the type and depth of information delineated in SRP Section 11.5, Part I, Items 1 and 2 (PSAR level).

b. Provide plant specific numbers, indicating the specific location for each type of monitor for the gaseous process and effluent monitors, the liquid process and effluent monitors, and the area radiation monitors.

Response 410.139

a. The issue is considered to be a question of level-of-detail necessary for design certification. The detailed design will depend on vendor supplied information, source locations, and discharge pathways. Adequate information is provided through design criteria and the system description discussed in sections 7.5 and 11.5 of CESSAR-DC to ensure that the Radiation Monitoring System meets all design criteria specified in the Standard Review Plan, Section 11.5, Regulatory Guide 1.97, and NUREG-0737. As the plant design is completed, the Radiation Monitoring System will be designed to ensure compliance with acceptance criteria per Standard Review Plan 11.5.

b. The process, effluent, area and airborne monitors can not be located at this time because they depend on air flow patterns and structure design (which is out of scope) which will be specified when detailed pipe routing, equipment locations and structure layouts are determined during final design. Therefore, plant specific numbers can not be assigned at this time. These monitors will be located and the type of monitor will be selected during detailed design after design certification. However, the air flow diagrams in Section 9.4 of CESSAR-DC will be submitted per response to a request for additional information, question 471.36.

Question 410.139

c. In accordance with SRP 11.5, the design should provide for monitoring the exhaust from the turbine gland seal condenser separately or direct the exhaust to the plant vent. There is not sufficient information in the section to assess compliance.

Response 410.139

c. The turbine gland seal condenser exhaust will be sent to the atmosphere through the unit vent. Therefore, no separate monitor will be provided. Sections 10.4.3.1 and 10.4.3.2 have been updated to indicate that the turbine gland seal condenser exhaust will be sent to the atmosphere through the unit vent.

Question 410.139

e. Provide the details of the system for monitoring effluents that result from accidents, showing conformance with Table 2 and Position C of Regulatory Guide 1.97.

Response 410.139

e. Table 7.5-3 of CESSAR lists post-accident instrumentation provided specifically to comply with Table 3 of Regulatory Guide 1.97, Revision 3. The RMS has effluent monitors under both Type C & E variables. The following monitors from Table 7.5-3 are considered the effluent radiation monitors required by Regulatory Guide 1.97.

Effluent Post-Accident Monitors	Variable Type	Design and Qualification Category
1) High Range Containment Area Monitors (2 monitors) (refer to CESSAR Section 11.5.1.2.6.D)	C, E	1
2) Unit Vent Monitor (particulate, iodine, low & high noble gas) (refer to CESSAR Section 11.5.1.2.3.1.B)	C, E	2
3) Unit Vent Post-Accident Monitor (high range ion chamber) (refer to CESSAR Section 11.5.1.2.3.1.C)	C, E	2
4) Main Steam Line Monitors (2 monitors) (refer to CESSAR Section 11.5.1.2.6.A)	E	2

CESSAR section 7.5.2.5 provides details of the Post-Accident Monitoring Instrumentation (PAMI). This section describes how the design and qualification criteria listed in Table 1 of Regulatory Guide 1.97 (Rev. 3) are met for Category 1, 2, and 3 instruments.

The following monitors also cover potential effluent pathways but are not considered required under Reg. Guide 1.97 because they discharge through the common plant vent. (See section 11.5.1.2.3.1 and 11.5.1.2.4 for monitor descriptions) These monitors are designed to meet commercial grade standards.

- Containment Atmosphere Monitor
- Containment High Purge Exhaust Monitor-Containment Low Purge Exhaust Monitor
- Reactor Building Annulus Monitor
- Reactor Building Subsphere Ventilation Monitor
- Nuclear Annex Building Ventilation Monitors
- Steam Jet Air Ejector Monitor
- Fuel Building Ventilation Monitor
- Radwaste Building Ventilation Monitor

10.4.2.2 System Description

The Main Vacuum System consists primarily of vacuum pumps and steam jet air ejectors (SJAEs) which are used to pull a vacuum on the main condenser. A E

There is no direct connection between the Main Vacuum System and the Reactor Coolant System; therefore, normal function of one will not directly affect the other. The SJAE air discharge is continuously monitored for radiation to detect steam generator primary-to-secondary tube leaks. A I

10.4.2.3 Safety Evaluation

The system is not assigned a safety class as it serves no plant safety function. It is not required for safe shutdown of the plant. A

10.4.2.4 Tests and Inspections

The system is fully tested and inspected before initial plant operation and is subject to periodic inspections after startup. System performance will indicate proper function of the system and any system malfunction will be corrected by appropriate means. E

10.4.2.5 Instrument Application

The Main Vacuum System includes sufficient instrumentation to assure proper operation. All of the instrumentation for this system is operating instrumentation and none is required for safe shutdown of the reactor. A

10.4.3 TURBINE GLAND SEALING SYSTEM E

10.4.3.1 Design Bases

The Turbine Gland Sealing System (TGSS) serves the main turbine, and is designed to seal the annular openings where the turbine shaft emerges from the turbine shell casings to prevent steam outleakage and air in-leakage along the turbine shaft. The TGSS prevents air leakage and steam leakage through the turbine shaft glands and through various steam valve stems. The TGSS also returns the air-steam mixture to the turbine gland steam packing exhauster/condenser (GSC), condenses the steam, returns the drains to the main condenser, and exhausts the noncondensible gases to the atmosphere. I E

through the unit vent.

10.4.3.2 System Description

The TGSS consists of labyrinth type turbine shaft seals, a steam seal supply and exhaust header, gland steam seal feed valve, gland steam packing exhauster/condenser (GSC), condenser drain hold tank, and the associated piping and valves. For the system to function satisfactorily from startup to full load, a fixed positive pressure in the steam seal supply header and a fixed vacuum in the outer ends in all of the turbine glands must be maintained at all loads. The TGSS also receives steam seal leakoff from turbine control valves. I E

On cold startup of the steam generators or during emergencies when the normal steam supply is not available, sealing steam is provided by the auxiliary steam system. The steam discharge ends of all glands are routed to the GSC that is maintained at a slight vacuum by the redundant motor-driven blowers. The GSC is a shell and tube heat exchanger. Condensate from the condensate system is used to condense the steam from the mixture of air and steam drawn from the shaft packings. Drains from the GSC are returned to the main condenser, and the noncondensibles are discharged to the atmosphere ~~via the effluent filtration system.~~ through the unit vent. I E I E

When the steam generator has been brought up to full pressure, the auxiliary steam source is closed and main steam provides sealing. As the turbine is brought up to load, steam leakage from the high-pressure packings enters the steam-seal header. When this leakage is sufficient to maintain steam-seal header pressure, the main steam source valve is closed, and sealing steam to all turbine seals is supplied from the high-pressure (HP) packings. At higher loads, when more steam is leaking from the HP packings than is required by vacuum packings, the excess steam is discharged to the main condenser. I

In case of a malfunction of the GSC, a motor-operated bypass valve is opened and manually controlled to maintain steam-seal header pressure. Vacuum in the GSC can be maintained with one or both blowers in operation. Loss of both blowers may cause sufficient steam to blow through the seals into the turbine area and thus necessitate shutdown of the turbine. Relief valves on the steam-seal header prevent excessive steam seal pressure. The valves are vented to atmosphere. E

10.4.3.3 Safety Evaluation

The TGSS has no safety function. Turbine Gland Sealing System valves are arranged for fail safe operation to protect the turbine.

Radiation monitoring equipment is designed for service based on expected environmental conditions during normal operation and anticipated occurrences. These conditions include temperature, pressure, humidity, chemical spray (where applicable), and radiation exposure. Post-accident radiation monitors meet the special requirements of Regulatory Guide 1.97 including equipment qualification, redundancy, power source, channel availability, quality assurance, display and recording, range, interfaces, testing, calibration, and human factors. Further discussion of compliance with Reg. Guide 1.97 is contained in sections 7.1.2.26 and 7.5.2.5.

The post-accident radiation monitors consistent with Regulatory Guide 1.97 are the high range containment monitors, primary coolant monitors, main steam line monitors, unit vent monitor, unit vent post-accident monitor, and selected area radiation monitors which cover areas where access may be required to service equipment important to safety. The post-accident area radiation monitor locations are selected based on the results of post-accident shielding analysis and design information on equipment location and access requirements. (See post-accident dose assessment in Chapter 12.) I

11.5.1.2.2 Control Room Interface

Primary indication of radiation levels and alarms is handled through the DIAS and DPS systems including both post-accident and non-post-accident monitors. Control room display of post-accident radiation monitoring parameters is in compliance with the requirements of Regulatory Guide 1.97 as described in Chapter 7.

Via the DPS and DIAS systems, control room operators can obtain detailed information on monitor readings, alarm setpoints, and operating status. A digital communications network is used to interface these systems with each monitor microprocessor. Operators can access information on monitor configuration and historical trends, and diagnose problems from operation status alarms. A failure in any individual microprocessor does not affect the operation of any other microprocessor nor does it fail the communications network.

Dedicated operator control modules are also available to change microprocessor database items, initiate certain monitor control functions, and change monitor alarm setpoints. These control functions include starting or stopping sample pumps, manual checksource actuation, monitor purge initiation, and moving filter paper advance. Alert alarm setpoints are set at a level determined by operating personnel to allow the observation of differential changes in activity levels. High alarm setpoints

Question 410.139

d. The design of the process and effluent monitoring systems must meet the guidelines of Appendix 11.5-A of SRP 11.5, Position C and Table 2 of Regulatory Guide 1.97, and Position C of Regulatory Guide 4.15. CESSAR should address whether the administrative and procedural controls will meet the above guidelines.

Response 410.139

d. The design of the process and effluent monitoring systems meets the guidelines of Appendix 11.5-A of SRP 11.5. The design meets Position C and Table 3 of Regulatory Guide 1.97, Revision 3. In addition the design conforms to Position C of Regulatory Guide 4.15.

Several of the process and effluent monitors actuate signals for termination of effluent releases. The Containment High Purge Exhaust and Containment Low Purge Exhaust Monitors isolate their respective purge exhaust flows upon detection of radiation levels above preset limits. Unacceptable liquid release is terminated by the Liquid Waste Discharge, Turbine Building Drains, Steam Generator Drain Tank Dis-charge, and Containment Cooler Condensate Tank Monitors. Also, upon indication of high gaseous activity, the Fuel Building Ventilation Monitor automatically diverts the exhaust flow from the Fuel Building through the Fuel Building Exhaust Filters. (Reference Tables 11.5-1, 11.5-2, and 11.5-3 in CESSAR.)

The process and effluent monitors meet the Category 1, 2, or 3 design and qualification criteria from Position C of Regulatory Guide 1.97, Revision 3. These requirements include those for display and recording of data, human factor concerns, etc. Range specifications conform to Table 3 requirements. (Reference Sections 7.1.2.26 and 7.5.2.5 in CESSAR)

As specified in Position C of Regulatory Guide 4.15, written procedures will be prepared, reviewed, and approved for sample collection, preparation, and analysis. Procedures will also exist for the use of radioactivity reference standards, detector calibration and checks of the radiation monitor systems, and for reduction, evaluation and reporting of data. The accuracy of sample flow rate devices will be determined on a regularly scheduled basis. Adjustments to the instrumentation will be made as needed to bring performance into specified limits. The frequency of these calibrations will be specified and results will be recorded. Also, collection efficiencies of the samplers used will be documented.

Section 11.5.1.4 has been added to the CESSAR to discuss how the administrative and procedural controls meet the guidelines referenced in Regulatory Guide 4.15.

radiation levels. A high range ion chamber detector is located next to each of the Reactor Coolant System hot legs to provide a seismically and environmentally qualified indication of a breach of fuel cladding following a loss of coolant accident. Control room indication and alarms are provided in compliance with Regulatory Guide 1.97 requirements for post-accident monitoring as described in Chapter 7.

D. High Range Containment Area Monitors

The high range containment area monitors consist of two physically independent and electrically separated ion chambers located inside the reactor containment away from the influence of the Reactor Coolant System to measure high range gamma radiation. This monitor gives operators a seismically and environmentally qualified indication of containment airborne activity. The design and qualification of these monitors meet the requirements of Regulatory Guide 1.97 for Category I instruments. Dose rate readings are correlated to determine airborne concentrations based on expected accident source terms and the time after an accident. Control Room indication and alarms are provided in compliance with Regulatory Guide 1.97 requirements for post-accident monitoring as described in Chapter 7. I

11.5.1.3 Calibration and Maintenance

Commercially available equipment with industry proven technology is incorporated into the design of the Radiation Monitoring System. Monitoring equipment is factory tested and calibrated with provisions made for periodic field calibrations to verify proper detector response. Factory calibration includes isotopic calibration using an adequate number of isotopes to accurately determine the response of the equipment. The accuracy of these calibrations can be traced to the National Bureau of Standards. Secondary calibration sources and decay curves are supplied with the equipment.

Radiation Monitoring System equipment is checked and inspected on a periodic basis. Setpoint checks are performed on a monthly basis with detector calibrations performed once per refueling cycle. Detectors are also calibrated if an inadequate checksource response indicates a problem or following any other equipment maintenance that could affect the accuracy of the instrument indication.

11.5.1.4 Administrative and Procedural Controls

[See insert]

[INSERT]

11.5.1.4 Administrative and Procedural Controls

As specified in Position C of Regulatory Guide 4.15, written procedures will be prepared, reviewed, and approved for sample collection, preparation, and analysis. Procedures will also exist for the use of radioactivity reference standards, detector calibration and checks of the radiation monitor systems, and for reduction, evaluation and reporting of data. The accuracy of sample flow rate devices will be determined on a regularly scheduled basis. Adjustments to the instrumentation will be made as needed to bring performance into specified limits. The frequency of these calibrations will be specified and results will be recorded. Also, collection efficiencies of the samplers used will be documented.

Question 730.1 (GSI 51)

Provide additional details on the proposed testing and maintenance requirements. In particular address

a) the need for periodic visual inspection and inspection of water samples for biological fouling organisms (items A and D of the recommended program to resolve Generic Issue 51: Generic Letter 89-13, Enclosure 1.)

b) the capability to clean all SWS surfaces.

Response 730.1 (GSI 51)

a) The station service water intake will be visually inspected, once per refueling cycle, for macroscopic biological fouling organisms, sediment, and corrosion. Inspections should be performed either by scuba divers or by dewatering the intake structure or by comparable methods. Any fouling accumulations should be removed.

Also, samples of water and substrate will be collected annually to determine if biological fouling organisms have populated the water source. Upon the detection of biological fouling organisms, appropriate corrective action, such as the modification of the chemical treatment program, should be taken. However, consideration must be given to environmental regulations.

This response is being incorporated into CESSAR-DC Section 9.2 and CESSAR-DC Appendix A.

b) The capability to clean SSWS surfaces will be provided.

This response is being incorporated into CESSAR-DC Section 9.2.1 and CESSAR-DC Appendix A.

A. The SSWS has the capability to dissipate the heat loads for safe reactor shutdown.

Loss of offsite power results in the shutdown and restarting of the SSWS pumps in accordance with the diesel generator load sequencing. The diesel generator load capacity and sequencing times are commensurate with SSWS requirements. Thus, safe reactor shutdown is supported by the SSWS.

B. The SSWS maintains the CCW heat exchanger outlet temperature at or below 120°F for the design basis accident.

C. The SSWS is comprised of two physically separate, independent, full capacity divisions, each of which is powered from separate emergency channels and a separate diesel generator. This ensures that a single failure does not impair system effectiveness. Refer to Table 9.2.1-1 for the single failure analysis.

D. The SSW pumps are located in Seismic Category I pump structures to protect the pumps against adverse environmental occurrences. Other required portions of the SSWS are either installed underground or are located in buildings that also protect against adverse environmental conditions. E

E. Flow differential is monitored between SSW pump discharges and the return lines to the UHS. Since the SSWS operates at a lower pressure than the CCWS, leakage of raw water from the SSWS into the CCWS is precluded.

F. Wetted surfaces in the SSWS are of materials compatible with the UHS water chemistry. Organic fouling and inorganic buildups are controlled by proper water treatment (Refer to Section 9.2.5). The capability to clean all SSWS surfaces is provided.

G. The SSWS is designed as Seismic Category I.

H. During normal plant operation, the SSWS is operating. The redundant features of the SSWS allow testing without violation of technical specifications.

I. Components of the SSWS are located such that flooding, tornado missile damage, internal missiles, pipe breaks and whip, jet impingement and interaction with non-seismic systems from any source will not prevent the system from performing its design function. I

J. To prevent damage to components and piping, the system is designed to minimize the potential for water hammer by providing adequate filling and high point venting.

9.2.1.4 Inspection and Testing Requirements

During fabrication of the SSW components, tests and inspections are performed and documented in accordance with code requirements to assure high quality construction. As necessary, performance tests of components are performed at the vendor's facility. The SSWS is designed and installed to permit in-service inspection and tests in accordance with ASME Code Section XI.

9.2.1.4.1 SSWS Performance Tests

Prior to initial plant startup, a comprehensive performance test as detailed in Section 14.2 will be performed to verify that the design performance of the system and individual components is attained.

9.2.1.4.2 Reliability Tests and Inspections

A. System Level Tests

After the plant is brought into operation, periodic tests and inspections of the SSW components and subsystems are performed to ensure proper operation. Scheduled tests and inspections are necessary to verify system operability. A complete schedule of tests and inspections of the SSWS is detailed in Chapter 16, Technical Specifications. I

B. Component Testing

In addition to the system level tests, tests to verify proper operation of the SSW components are also conducted. These tests supplement the system level tests by verifying acceptable performance of each active component in the SSWS.

Pumps and valves are tested in accordance with ASME Section XI. Various flow rate testing up to and including the design point of the SSW pumps can be performed using the system loop.

9.2.1.5 Instrumentation Requirements

The SSW instrumentation facilitates automatic operation, remote control, and continuous indication of system parameters (UHS water temperature, station service water pump flow, UHS water level) both locally and in the control room.

Process indications and alarms are provided to enable the operator to evaluate the SSWS performance and to detect malfunctions. Station service water pump discharge pressure is

ADD INSERT A

CESSAR-DC Attachment (Refer to page 9.2-10)

Insert A:

The station service water intake will be visually inspected, once per refueling cycle, for macroscopic biological fouling organisms, sediment, and corrosion. Inspections should be performed either by scuba divers or by dewatering the intake structure or by comparable methods. Any fouling accumulations should be removed.

Heat Sinks which may be specified for a particular site if environmental restrictions limit the use of a cooling pond or if an alternative water supply is more reliable. Acceptable alternate ultimate heat sinks are an ocean, a large lake, a large river, a lake and a cooling pond, a river and a cooling pond, or a cooling tower and cooling pond.

The cooling water pond is provided with redundant makeup water pump to maintain level. Water chemistry is maintained by a site-specific water treatment system (i.e., chemical injection). Salinity buildup in a pond is limited by blowdown.

The Ultimate Heat Sink will operate for the required nominal 30 days following a postulated LOCA without requiring any makeup water to the source, and without requiring any blowdown from the pond for salinity control. E

9.2.5.3 Safety Evaluation

The Ultimate Heat Sink meets the intent of Regulatory Guide 1.27. The cooling water pond is Seismic Category I and of sufficient volume to provide the required nominal 30-day cooling capacity without makeup and under worst case meteorological conditions.

Ultimate Heat Sink temperature will not exceed the maximum allowable temperature required for cooling any safety-grade component through the component cooling water heat exchangers during a design basis accident concurrent with a loss of offsite power. I

The function of the Ultimate Heat Sink is not lost during or after any of the following events:

A. Natural phenomena, including SSE, tornado, flood, and drought.

B. Non-concurrent site-related events, including transportation accidents, oil spills, and fires. E

C. Credible single failures of man-made structures.

D. Sabotage.

9.2.5.~~4~~5 Instrumentation Requirements

The level of each cooling water pond is monitored and controlled. Safety grade alarms warn if the level of the pond approaches minimum allowable value, or the temperature approaches the maximum allowable value.

ADD INSERT B

CESSAR-DC Attachment (Refer to page 9.2-59)

Insert B:

9.2.5.4 Inspection and Testing Requirements

Samples of water and substrate will be collected annually to determine if biological fouling organisms have populated the water source. Upon the detection of biological fouling organisms, appropriate corrective action, such as the modification of the chemical treatment program, should be taken. However, consideration must be given to environmental regulations.

To minimize fouling of the CCWS heat exchangers and the SSWS piping, prevent flow blockage and facilitate the maintenance of clean conditions, the following SSWS design features are provided, or required:

- The SSWS pump structures must be equipped with safety-grade traveling screens with a screen wash system. The screen mesh size must prevent flow blockage of the pump inlets, and limit ingestion of biofouling, organics, and debris. (see CESSAR-DC, Section 9.2.1.2.1.4).

- Strainers are provided at the SSWS pump discharges. The strainers are of the automatic backwash type and are designed to retain particles consistent with the fouling design limits of the component cooling water heat exchangers (see CESSAR-DC, Section 9.2.1.2.1.5).

- When required by the site-specific water chemistry and environmental regulations, the ultimate heat sink water must be chemically treated to reduce organic and non-organic fouling, corrosion, scaling, and to keep mud and silt in suspension. (see CESSAR-DC Section 9.2.5.2).

- The CCWS heat exchangers are either of the tube and shell or plate and frame design, dependent upon site selection (see CESSAR-DC Section 9.2.2.2.1.1). SSWS water flow is through the tube side of CCWS shell and tube heat exchangers and at a lower pressure than the CCWS to prevent contamination of the CCWS by in-leakage of SSWS water. In addition, the nominal flow conditions in CCWS heat exchanger tubes are in accordance with Heat Exchanger Institute standards for power plant heat exchangers.

- Adequate tube pull space is provided for periodic tube cleaning of the straight tube type CCWS heat exchangers.

- The CCWS heat exchangers have a 15 percent thermal performance margin to allow for potential fouling between cleaning operations (see CESSAR-DC, Section 9.2.2.2.1.1). The thermal performance can be verified using temporary instrumentation at test connections provided on each heat exchanger (see CESSAR-DC, Sections 9.2.1.5 and 9.2.2.5).

- Wetted surfaces of the SSWS and CCWS are of materials selected on a site-specific basis to be compatible with the respective cooling water chemistries and water treatments. The guidelines used for the selection of CCWS heat exchanger tube and tubesheet materials are given in CESSAR-DC Section 9.2.2.2.1.1.

ADD INSERT C

CESSAR-DC Attachment (Refer to page A-29)

Insert C:

- The station service water intake will be visually inspected, once per refueling cycle, for macroscopic biological fouling organisms, sediment, and corrosion. Inspections should be performed either by scuba divers or by dewatering the intake structure or by comparable methods. Any fouling accumulations should be removed. (see CESSAR-DC Section 9.2.1.4.2).

- Samples of water and substrate will be collected annually to determine if biological fouling organisms have populated the water source. Upon the detection of biological fouling organisms, appropriate corrective action, such as the modification of the chemical treatment program, should be taken. However, consideration must be given to environmental regulations. (see CESSAR-DC Section 9.2.5.4).

- The capability to clean SSWS surfaces is provided. (see CESSAR-DC Section 9.2.1.3).

Question 730.2 (GSI 57)

Identify the criteria used to determine which equipment is to be shielded and which conduit ends are to be sealed from the effects of fire protection system sprays.

Response 730.2 (GSI 57)

Conduit ends: The open ends of all vertical conduit, and the open ends of all horizontal conduit that terminate within 18 inches of a floor, will be sealed to prevent water infiltration.

Equipment shielding: It is not expected that shielding from the effects of water spray from overhead sprinkler systems will be necessary. Sprinklers in safety related areas will be of the automatic pre-action type that requires the activation of an automatic fire detector and fusing of a sprinkler head prior to releasing water. A pipe break downstream of the pre-action control valve will not release water. Shielding from spray from manual fire fighting operations will not be required outside of containment. Redundant safety related equipment is separated with 3-hour fire rated barriers which will confine the fire and fire fighting operations to a single area. From a safe shutdown standpoint it is assumed that the fire will render the equipment in the affected area inoperable, and safe shutdown will be accomplished using the redundant division. Therefore, the wetting of safety related equipment in the affected area will be of no consequence. All penetration seals in floors and walls up to a height of 24 inches will be waterproofed to prevent water from the affected area from migrating to adjacent areas.

Safety related equipment in close proximity to fittings in the standpipe and interior fire hose system will be shielded as necessary to prevent damage from inadvertent discharge. Shielding location will be finalized following as-built walkdowns.

Inside containment, where redundant division equipment is located in close proximity, (i.e., within 20 feet of each other), such as the motor operated depressurization valves located at the pressurizer, shielding will be provided as deemed necessary following interaction review during as-built walkdowns.

In addition, as described in CESSAR-DC Section 9.5.1.6.3 detrimental effects to safety related equipment due to fire protection water discharge will be mitigated through the use of equipment mounting pedestals, curbs, and installation of floor drains sized to accommodate the anticipated fire protection waterflow.

A marked-up copy of a revision to CESSAR-DC Section 9.5.1.6 is attached. This revision will be incorporated in a future CESSAR-DC update. Sections 9.5.1.6.3 through 9.5.1.6.6 will be renumbered accordingly.

The smoke control design philosophy is to allow for smoke venting from any plant area without spreading to adjacent areas, to maintain plant habitability for operator protection and to ensure protection of the public. The containment, subsphere, fuel pool, nuclear annex and two diesel buildings are each served by 100% outside air and 100% exhaust ventilation systems.

Smoke control and exhaust is accomplished by aligning the ventilation to supply 100% outside air and to exhaust directly to the outside. Smoke and gases containing radioactive materials are routed through a filter train to the unit vent if a radioactive signal is received. The control complex has smoke exhaust fans to remove smoke from specific areas as determined by control operators utilizing signals from smoke detectors located in exhaust and return air ducts. The control operator aligns dampers to exhaust an area where fire occurs while isolating exhaust and return air in adjacent areas while supply dampers remain open to create a slight positive pressure in adjacent areas.

Fresh air intakes are located remote from the ventilation system exhaust to preclude the possibility of contaminating the intake air with products of combustion. I

Stairwells in the Nuclear Annex are individually pressurized with roof-mounted fans to preclude smoke infiltration.

Carbon and high energy particulate air (HEPA) do not represent a potential exposure fire hazard to nearby safety related components. Carbon, used in carbon filters, has a minimum ignition temperature of 625°F. HEPA filters have a minimum ignition temperature of 600°F. Normal heating system air temperature is about 105°F. If the air temperature approaches 200°F, carbon will begin to release any adsorbed radioactive iodine. If an air temperature excursion occurs in the safety related ventilation system with carbon or HEPA filters, the heat sensor will cut off the filter train fan and the redundant fan serving the redundant division will begin to serve the area involved; therefore, the fire will be isolated.

← Place Insert on next sheet here →

9.5.1.6.3 4 Curbs and Drains

Where fixed fire protection systems are installed, floor drains are provided, sized to collect water discharge. In areas where drains are not installed due to pressure boundary constraints, equipment susceptible to water damage is installed on six-inch elevated curbs.

CESSAR-DC INSERT FOR PAGE 9.5-24

9.5.1.6.3 Equipment Water Shields

Protection of equipment susceptible to water damage required for safe shutdown of the plant from inadvertent or advertent discharge of water from fire protection systems will be through use of water shields, conduit seals, curbs and drains, and equipment pedestals.

Equipment shielding. It is not expected that shielding from the effects of water spray from overhead sprinkler systems will be necessary. Sprinklers in safety related areas will be of the automatic pre-action type that requires the activation of an automatic fire detector and fusing of a sprinkler head prior to releasing water. A pipe break downstream of the pre-action control valve will not release water. Shielding from spray from manual fire fighting operations will not be required outside of containment. Redundant safety related equipment is separated with 3-hour fire rated barriers which will confine the fire and fire fighting operations to a single area. From a safe shutdown standpoint it is assumed that the fire will render the equipment in the affected area inoperable, and safe shutdown will be of no consequence. All penetration seals in floors and walls up to a height of 24 inches will be waterproofed to prevent water from the affected area from migrating to adjacent areas.

Safety related equipment in close proximity to fittings in the standpipe and interior fire hose system will be shielded as necessary to prevent damage form inadvertent discharge. Shielding location will be finalized following as-built walkdowns.

Inside containment, where redundant division equipment is located in close proximity, (i.e., within 20 feet of each other), such as the motor operated depressurization valves located at the pressurizer, shielding will be provided as deemed necessary following interaction review during detailed design and as-built walkdowns.

Conduit ends. The open ends of all vertical conduit, and the open ends of all horizontal conduit that terminate within 18 inches of a floor, will be sealed to prevent water infiltration.

Question 730.3
(GSI 83)

a. Although the method for the performance of a radiological analysis is discussed, the results of this analysis are not provided. Additionally, the required toxic chemical release analysis is not addressed. The results of these analyses are to be provided.

b. Provide the following information as identified in Attachment 1 to safety issue III.d.3.4.

1) item 2i - automatic isolation capability-damper closing time, damper leakage and area.

item 2j - chlorine detectors or toxic gas (local or remote)

item 2k - self contained breathing apparatus availability (number)

item 2l - bottled air supply (hours supply)

item 2m - emergency food and potable water supply (how many days and how many people)

item 2o - potassium iodide drug supply

2) item 3 - Onsite storage of chlorine and other hazardous chemicals

a - total amount and size of container

b - closest distance from the control-room air intake

item 5 - Technical Specifications for the chlorine detection system and control room emergency filtration system including the capability to maintain the control room pressurization at 1/8 in. water gauge, verification of isolation by test signals and damper closure times, and filter testing requirements.

Response 730.3
(CSI 83)

a. The results of the radiological analysis after a LOCA that deals with ensuring that the control room design is adequate to prevent the loss of control room habitability are provided in CESSAR-DC Table

15.6.5-2. The toxic chemical release analysis is site specific since location of toxic chemicals is site dependant. An interface requirement to perform this analysis has been added to Section 6.4.1.

b. The item 2i, intakes for the Control Room are provided with redundant dampers which automatically close on the detection of high radiation, smoke, chlorine or toxic gas. Damper closing time, leak rate and leakage area is dependant on as-procured information. Therefore, this information is not available for design certification.

The item 2j, chlorine detectors or toxic gas (local or remote), are shown on the Figure 9.4-2 attached to the response to NRC RAI 410.116.

The item 2k, self contained breathing apparatus availability (number), will be addressed by the owner operator.

The item 2l, bottled air supply (hours supply), will be addressed by the owner operator.

The item 2m, emergency food and potable water supply (how many days and how many people), will be addressed by the owner operator.

The item 2o, potassium iodide drug supply, will be addressed by the owner operator.

The item 3, Onsite storage of chlorine and other hazardous chemicals (total amount and size of container, closest distance from the control-room air intake), is site specific and will be addressed during site specific design.

The item 5, Technical Specifications for the chlorine detection system and control room emergency filtration system including the capability to maintain the control room pressurization at 1/8 in. water gauge, verification of isolation by test signals and damper closure times, and filter testing requirements, are provided in CESSAR-DC 16.0 Technical Specifications Section 3.7.12 Control Building Ventilation System.

6.4 HABITABILITY SYSTEMS

Habitability systems are the HVAC systems for the Control Building which are safety-related systems that must fulfill the following requirements during all normal and postulated accident conditions to ensure that continuous occupancy can be maintained.

A. Maintain conditions comfortable to personnel and ensure the continuous functioning of the control room equipment.

B. Protect personnel from exposure to potential airborne radioactivity present in the outside atmosphere surrounding the control building.

C. Protect personnel from exposure to potentially toxic chemicals that are postulated to be released in areas surrounding the control building. I

D. Protect personnel from the effects of high-energy line ruptures in surrounding plant areas.

E. Protect personnel from products of combustion that are postulated from fires on the site.

6.4.1 DESIGN BASES

6.4.1.1 Safety Design Bases

A. The Control Building Ventilation System is capable of maintaining out-leakage of control room air when using outside air. The system is also capable of isolation from the outside air intake. Internal temperatures are maintained at a habitable level by internal recirculation cooling only.

B. The radiation exposure of control room personnel for accident conditions described in Chapter 15 does not exceed the limits set by General Design Criterion 19 of 10 CFR 50, Appendix A.

C. The shielding design is based on the most limiting design basis accident assumptions; those applicable portions of Regulatory Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors." E

D. The emergency air purification and cooling systems for the Control Room are designed to Seismic Category I requirements as in the control complex structure.

E. Fire protection for the control room is provided by alarm systems and portable fire extinguishers. The Fire Protection System is discussed in Section 9.5.1.

F. The intent of "housekeeping requirements" set out by Regulatory Guide 1.39 are met.

G. The quantities and uses of onsite and offsite hazardous chemicals will be controlled by administrative procedures.

Insert 1

6.4.2 SYSTEM DESCRIPTION

6.4.2.1 General

The Control Building Ventilation System description is provided in Section 9.4.1. Component descriptions are also provided in Section 9.4.1.

Climatic conditions in the control room are maintained by cooling and heating units that automatically control the temperature and limit the humidity within the comfort zone for operating personnel. In doing so, the climatic conditions required for the equipment located in the control room are also satisfied.

6.4.2.2 System Operation

The Control Building Ventilation System will be furnished with dual air inlet structures, structures 'A' and 'B' which met the intent of paragraph C of Regulatory Guide 1.78. Each air inlet structure will be furnished with a radiation monitoring device which controls the opening and closing of the dampers in each structure according to the contamination level of the air at the structure. For instance, if the monitoring equipment at structure 'A' detects a certain level of contamination in the air entering the structure, it will signal the dampers at structure 'A' to automatically close. As the radiation contamination level in the air diminishes to a safe level, the radiation monitoring device will produce a signal in the control room which permits the operator to re-open the dampers. The same procedure would hold true for structure 'B'. If the air at both structures reaches a certain contamination level, the monitoring devices will signal the dampers at both structures to close. At this time, the Control Room Ventilation System shifts to 100% return air circulation. E

In order to safe-guard the control room from hazardous chemical release in the air, chemical instrumentation will also be provided If structure 'A' detects a certain level of chemical pollution in the air, the instruments signal the dampers at structures 'A' to automatically close. as the chemical pollution in the air diminishes to a safe level, the instruments then provide a signal in the control room which permits the operator to re-open the dampers. The same procedure would hold true for structure 'B'. If the air at both intake structures becomes

Insert 1

6.4.1.2 Interface Requirements

The site-specific SAR shall verify that the following interface requirements are met to ensure adequacy with the System 80+ Standard Design:

A. The toxic chemical release analysis will be performed on a site specific bases since location of toxic chemicals is site dependant.

Question 730.4 (GSI 93)

Steam Binding of Auxiliary Feedwater System Pumps

a. Describe the surveillance procedures for the temperature sensor located between the flow control valve and the isolation valve on each Emergency Feedwater subtrain. In particular, is this sensor to be monitored once per shift? Is the alarm associated with this sensor monitored or "on-line" continuously?

b. Describe the guidelines to be used to set the procedures for recognizing the effects of steam binding of the AFW pumps and for restoring the AFW System to operable status following a steam binding incident.

Response 730.4 (GSI 93)

a. The temperature sensor located between the EFW flow control valve and the isolation valve on each subtrain is continuously monitored and audibly alarmed in the control room.

Provisions are made such that in the event of loss of control room indication, the sensor can and will be monitored locally. Operating procedures, which are the responsibility of the owner-operator will present the requirements for local monitoring. At a minimum, readings shall be recorded at least once a shift, and before and after each EFW pump run.

b. The EFW system is designed to avoid steam binding of the EFW pumps by continuous system venting through the EFW storage tanks and by the use of normally closed isolation valves upstream of the interface with the Main Feedwater system; however, in the event that steam binding of the EFW pumps does occur, the control room alarm associated with the temperature sensor discussed above will signal the plant operator to vent the EFW pumps. Plant operating procedures developed by the owner-operator will prescribe this action.

Each major train, which consists of two subtrains (see CESSAR-DC, Section 10.4.9), contains:

1. one emergency feedwater storage tank (EFWST),
2. a motor-driven and a steam-driven pump (each with a capacity of 500 GPM),
3. one flow control valve per subtrain,
4. one isolation valve per subtrain,
5. one check valve per subtrain,
6. a cavitating venturi, and
7. specified instrumentation.

The main defense against steam binding of the EFW Pumps results from the system design for normal plant operation.

Although some plant systems operate with the flow control and the isolation valves open during normal plant operation, the System 80+ Standard Design EFW system is designed to operate with the isolation valves closed. The closed isolation valves act as a backup to the EFW line check valves, thus providing redundant isolation of the EFW System from the MFW System. CESSAR-DC Section 10.4.9 states that the isolation valve will be closed during normal plant operation. When a steam generator low level occurs, the Emergency Feedwater Actuation Signal (EFAS) starts the EFW pumps (the motor and steam driven), opens the isolation valves, and assures that the feedwater flow control valves are open, allowing EFW flow to each steam generator.

Each EFW subtrain is separated from the other. Each subtrain has its own suction line from the EFWST, its own discharge line through the steam generator isolation valve and check valve, and the pump crossover lines contain redundant, locked closed isolation valves. Thus, the potential for common mode failure of steam binding of all EFW pumps does not exist, should one set of steam generator isolation and check valves leak. The EFW pump suction and recirculation lines are normally open so that, should leakage of a steam generator isolation and check valve occur, any resulting steam can be vented through the EFWST vent.

Associated instrumentation is provided for each train to assure adequate control and monitoring of the EFW system. Temperature indicators (TI's) are located between the flow control and motor-operated isolation valves (MOV's). These TI's provide a direct indication of the fluid temperature and ~~alarm~~ audibly alarm in the Control room on high fluid temperature in the EFW system downstream of the EFW pumps.

This alarm warns the operator that leakage through the steam generator isolation valve and check valve is occurring. Therefore, these sensors provide indication to the operator of the potential of steam binding of the EFW pumps.

RAI 730.4

10.4.9.5.1 Pressure Instrumentation

A. Emergency Feedwater Pumps Discharge Pressure

The main control room and remote shutdown panel are provided with motor-driven EFW pumps 1 and 2 and steam-driven EFW pumps 1 and 2 discharge pressure indication.

B. Emergency Feedwater Pumps Suction Pressure

The main control room and remote shutdown panel are provided with motor-driven EFW pumps 1 and 2 and steam-driven EFW pumps 1 and 2 suction pressure indication and low pressure alarm.

C. Emergency Feedwater Pump Turbines Inlet Pressure

The main control room and remote shutdown panel are provided with EFW pump turbines 1 and 2 inlet pressure indication.

D. Pressure Test Points C

Pressure test points are provided at the following locations:

1. EFW Pump Turbines 1 and 2 Steam Inlets.
2. EFW Pump Turbines 1 and 2 Steam Exhausts.
3. EFW Steam-Driven Pump Turbine Bearing Oil Coolers 1 and 2 Inlet.
4. EFW Steam-Driven Pump Turbine Bearing Oil Coolers 1 and 2 Outlet.
5. Each EFW Pump Suction.
6. Each EFW Pump Discharge.

10.4.9.5.2 Temperature Instrumentation

A. Steam Generator Isolation Valves Upstream Temperature

The main control room is provided with temperature indication upstream of steam generator isolation valves and a high temperature alarm for detection of back leakage and steam voiding.

an audible

Question 730.5

Contrary to the statement in Appendix A the hydrogen lines are not described as Seismic Category I, sleeved or containing shutoff valves in Section 9.5.10. Since no P&IDs are provided these contradictory statements need to be clarified. In Section 9.5.10 it is specifically stated that all hydrogen piping is non-seismic.

Response 730.5

CESSAR-DC Section 9.5.10 will be revised to include the requirements of Standard Review Plan (SRP) 9.5.1 for hydrogen lines located in safety-related areas. These lines will either be designed to Seismic Category I requirements, sleeved such that the outer piping is vented to the outside, or equipped with excess flow check valves so that in case of a line break, the hydrogen concentration in the affected area will not exceed 2%. This revision will coincide with the information in CESSAR-DC Appendix A (GSI 106) and will be included in a future revision to the System 80+™ CESSAR-DC.

Hydrogen supply piping located in safety-related areas is either designed to Seismic Category I requirements, or sleeved such that the outer pipe is directly vented to the outside, or is equipped with excess flow check valves so that in case of a line break the hydrogen concentration in the affected areas will not exceed 4%.

5. A nitrogen supply to the reactor drain tank of 20 scfm to maintain a 0-3 psig overpressure in the tank is provided. Approximately 40 scf/year of nitrogen is required.

6. A nitrogen supply to the boric acid concentrator of 20 scfm at 100 psig is available. Approximately 2500 scf/year of nitrogen is required.

7. All nitrogen supply piping is non-seismic.

8. The hydrogen gas is 99.95 percent H_2 and contains less than 10 ppm methane.

The hydrogen supply to the volume control tank is 1.5 to 20 scfm at 30 psig. Approximately 400,000 scf/year is required. To prevent hydrogen overpressurization of the Volume Control Tank, Relief Valve CH-105 set pressure is 70 psig.

The capability for adding hydrogen directly into the charging line exists. When used, a hydrogen flow rate of 0.5 scfm at 2400 psig is required. Approximately 10,000 scf/year required. Overpressurization protection is provided to prevent damage to CVCS piping/components in the event the regulating valve fails (set pressure is 2735 psig). ~~All hydrogen supply piping is non-seismic.~~ E

C. Safety Injection Tanks

Nitrogen gas is supplied to the safety injection tanks. This supply satisfies the following requirements:

Minimum Required Flow Rate	300 SCFM (at supply pressure)
Maximum Allowable Flow Rate	2490 SCFM (at supply pressure)
Minimum Supply Pressure	630 psig (for normal plant operation)
Maximum Supply Pressure	700 psig (all conditions)
Gas Volume Required for 4 Tank Blowdown	105,000 SCF
Design Criteria	ANSI B31.1
Maximum Water Content	0.1 percent
Minimum Supply Stream Stagnation Temperature	80°F
Maximum Supply Free Stream Temperature	115°F

Question 730.7 (USI 48/121)

a. In addressing USI 121 CE states that the equipment needed to mitigate the effects of a degraded core accident will be identified and a best estimate determination of the environment (including the effects of HMS actuation) to which this equipment will be exposed will be determined. CE should perform this analysis and the information should be provided as part of the CESSAR submittal. The equipment to be protected should be identified and the expected environmental conditions should also be identified.

b. The statement is made that the Hydrogen Management System (HMS) igniters are positioned in areas where hydrogen may accumulate most rapidly. Only a few such areas are identified in Section 6.2.5. The total number and capacity of the igniters is not specified nor are their locations. Provide this information. Similarly the statement is made that the containment structure facilitates natural circulation. Provide the analysis that was used to justify this statement and therefore shows a low likelihood of localized combustible mixtures.

Response 730.7

a. The previous response to RAI 281.57 (Letter LD-91-013, March 15, 1991) provides an indication of the severe accident environment in the containment and the responses to RAIs 440.18 and 440.20 (Letter LD-91-018, April 26, 1991) provide a discussion of hydrogen generation and control and equipment survivability.

Effects of HMS actuation will be addressed by locating igniters away from sensitive equipment. The evaluation for locating the igniters is summarized in part (b) of this response. The environment expected cannot be determined precisely for severe accident conditions. Since the igniters will be located using engineering judgement and since detailed MAAP analyses of environmental conditions are considered "best-estimate", Combustion Engineering believes that it is not appropriate to include such material in CESSAR-DC.

b. The evaluation, including engineering judgement, to determine Hydrogen Mitigation System igniter locations is currently in progress. Considerations to be included are the sources of hydrogen, equipment location, and collection at the top of containment. The number of igniters will not be minimized and it is anticipated that approximately 50 igniters will be distributed through containment. The results of this evaluation are anticipated to be included in a future CESSAR-DC amendment.

Response 730.7 (Cont'd)

The open containment design facilitates natural circulation and minimizes dead-ended compartments where hydrogen could accumulate. Grating is used extensively in containment, including the steam generator cubicles, instead of solid floors. The pressurizer cubicle has two large openings at the top for venting. The reactor cavity has openings around the RCS loop piping and in the pool seal, and receives continuous air circulation from the reactor cavity cooling fans. These features facilitate natural circulation and minimize the likelihood of combustible hydrogen concentrations accumulating in containment.

Question 730.8

Design Basis Criterion (C) in Section 11.4.1.1 specifies that the solid waste system must produce a packaged waste suitable for shipment to and acceptance at a licensed burial facility. Requirements for such acceptance appear in 10 CFR 61.56, and in NRC Branch Technical Position 11-3. Provide justification that solid waste to be shipped for disposal meets the requirements of 10 CFR 61.56(a) (1) through (a)(6), and BTP 11-3 regarding the maximum free liquid allowable in the solid waste and the means provided for its detection.

Response 730.8

The solid waste shall be disposed and processed in accordance with 10 CFR 61 requirements. Operating procedures will be developed by the Owner Operator. These procedures will provide boundary conditions for a set of process parameters, such as settling time, to assure that 10 CFR 61 requirements are met. In addition, resin storage tanks and shipping containers will be sampled and/or surveyed to classify waste and verify that the solidification or dewatering process is complete in accordance with guidance from Branch Technical Position ETSB 11-3 prior to shipment to licensed burial facility.

Question 730.10 (II.E.4.1)

In accordance with TMI Action Item II.E.4.1, Clarification 3, all components furnished to satisfy the dedicated hydrogen penetration requirement must be safety-grade. Provide a statement on the compliance with this requirement and any updates necessary on Figure 6.2.5-1 showing changes in equipment classification.

Response 730.10

As stated in CESSAR-DC, Amendment I, Section 6.2.5.1.1, the Containment Hydrogen Recombiner System (CHRS) is ANS Safety Class 2 (SC-2). Two dedicated CHRS containment penetrations (intake and discharge) are provided for each recombiner, as shown in CESSAR-DC, Amendment , Figure 6.2.5-1. Figure 6.2.5-1 will be revised in the next CESSAR-DC amendment to specify the safety class and safety class changes in the CHRS, including the dedicated containment penetrations which are Safety Class 2.

Question 450.3
(6.4)

a. The text states that the control room is pressurized and that, on presence of radioactive material at both inlets, both inlets will close. Identify the source and flow rate of make-up air which balances outleakage from the pressurized control room in this mode of operation. Which areas does control room leakage enter?

b. Table 9.4-2 indicates that the air flow rate through the control room A/C unit is 6,000 cfm and that flow rate through the control room filter unit is 2,000 cfm. Is this data consistent? If it is, provide an explanation of the difference in magnitude.

c. Figure 9.4-2 does not provide an unambiguous representation of the location of the control room and control room elements relative to the containment structure. What is the position and elevation of all control room inlet and exhaust vents on the nuclear annex building? The data should allow determination of distance of the vents from any point on the containment structure.

d. Discuss the elevation and location of plant vents, including positions relative to the control room ventilation inlet.

e. Provide a list of areas considered part of the control room emergency zone.

f. What is the emergency zone volume?

g. Under accident conditions with one inlet closed, what is the expected infiltration rate?

Response 450.3
(6.4)

a. In the event that both outside air intakes close, the control room operator can override the intake monitors and by inspection of the control room readouts elect to open the least contaminated source of makeup air. The 2000 cfm is the amount of makeup air to offset the maximum anticipated outleakage of 2000 cfm. The leakage from the control room enters adjacent areas.

b. This data is consistent in that the filter units are used during emergency situations to filter the 2000 cfm makeup air for the control room. The 6000 cfm is a combination of 4000 cfm recirculation and 2000 cfm makeup air due to outleakage from the control room.

c. The Figure 1.2-8 provides the physical locations of the control room air intakes. The bottom elevation of the control room air intakes is 130'-6". The Figure 1.2-3 provides a section through the reactor building and nuclear annex to allow determination of distance of the intakes from any point on the containment structure. These general arrangement drawings are being revised to incorporate the unit vent and other building changes and will be included in a future amendment of CESSAR-DC.

d. The filtered exhausts from plant ventilation systems are discharged through the unit vent at elevation 285'-0" located more than 200' from the control room air intakes. The Figures 1.2-2 and 1.2-3 are being revised to incorporate the location of the unit vent. The Figure 1.2-6 shows the diesel buildings exhaust relative to the control room ventilation inlet. These exhaust vents are located at least 200 feet away from the nearest control room ventilation intake so as not to allow diesel exhaust fumes to be brought into the control room area by the ventilation system. These drawings will be included in the next amendment of CESSAR-DC.

e. The control room emergency zone consists of the following areas:
- Control Room
- Reactor Operator Office
- Control Room Supervisor Office
- Emergency Supplies Room
- Integrated Plant Status Overview Room
- Document Room

f. The emergency zone volume is 67,300 cubic feet.

g. The maximum unfiltered infiltration rate into the control room emergency zone under accident conditions is 10 cfm.

These responses will be incorporated into CESSAR-DC in a future amendment. The revisions are attached.

F. The intent of "housekeeping requirements" set out by Regulatory Guide 1.39 are met.

G. The quantities and uses of onsite and offsite hazardous chemicals will be controlled by administrative procedures.

6.4.2 SYSTEM DESCRIPTION

6.4.2.1 General

The Control Building Ventilation System description is provided in Section 9.4.1. Component descriptions are also provided in Section 9.4.1.

Climatic conditions in the control room are maintained by cooling and heating units that automatically control the temperature and limit the humidity within the comfort zone for operating personnel. In doing so, the climatic conditions required for the equipment located in the control room are also satisfied.

Insert 1

6.4.2.2 System Operation

The Control Building Ventilation System will be furnished with dual air inlet structures, structures 'A' and 'B' which met the intent of paragraph C of Regulatory Guide 1.78. Each air inlet structure will be furnished with a radiation monitoring device which controls the opening and closing of the dampers in each structure according to the contamination level of the air at the structure. For instance, if the monitoring equipment at structure 'A' detects a certain level of contamination in the air entering the structure, it will signal the dampers at structure 'A' to automatically close. As the radiation contamination level in the air diminishes to a safe level, the radiation monitoring device will produce a signal in the control room which permits the operator to re-open the dampers. The same procedure would hold true for structure 'B'. If the air at both structures reaches a certain contamination level, the monitoring devices will signal the dampers at both structures to close. At this time, the Control Room Ventilation System shifts to 100% return air circulation. E

In order to safe-guard the control room from hazardous chemical release in the air, chemical instrumentation will also be provided. If structure 'A' detects a certain level of chemical pollution in the air, the instruments signal the dampers structures 'A' to automatically close. as the chemical pollution in the air diminishes to a safe level, the instruments then provide a signal in the control room which permits the operator to re-open the dampers. The same procedure would hold true for structure 'B'. If the air at both intake structures becomes

Insert 1

The control room emergency zone consists of the following areas:

- Control Room
- Reactor Operator Office
- Control Room Supervisor Office
- Emergency Supplies Room
- Integrated Plant Status Overview Room
- Document Room

TABLE 15A-10

CONTROL ROOM DATA

Item	Value
Maximum filtered air intake rate, CFM	2,000
Maximum unfiltered air intake rate, CFM	10
Nominal, filtered recirculation rate, CFM	4,000
Control room nominal net free volume, ft^3	~~100,000~~ 67,300
Intake and recirculating iodine filter efficiencies:	
elemental	0.95
organic	0.95
particulate	0.99

H

Question 480.5

In response to RAI 480.5 reference is made to a pipe guard. Provide descriptions and drawings to show how the pipe guard will contain ruptured high energy lines between the primary containment and its shield building.

Response 480.5

For guard pipe description and typical drawings refer to CESSAR-DC Section 3.8.2.1.3.4 and Figure 3.8-2. Final drawings will not be available until after the procurement process because they depend on as-procured pipe guard characteristics.

Question 480.34

Additional questions from the review of Amendment I

a. In Section 3.5.1.3.B provide justification for the use of abutments and foundations as missile barriers and shields.

b. The reference to Section 3.6.2.3.3 in Section 3.6.1.3.c apparently should read Section 3.6.2.3.2.5.

Response 480.34

a. "Abutments and foundations" will be excluded from CESSAR-DC Section 3.6.1.3.B. Note: This section involves barriers for pipe rupture, not missiles.

b. Agree. Reference will be changed to read "Section 3.6.2.3.2.5."

prevent loss of safety function as a result of hazards different from those for which the system is required to function, as well as for the specific event for which the system is required to be functional. Separation between redundant safety systems with their related auxiliary supporting features is the basic protective measure.

In general, layout of the facility followed a multistep process to ensure adequate separation.

1. Safety-related systems are located away from most high-energy piping.

2. Redundant (e.g., "A" and "B" trains) safety systems and subsystems are located in separate compartments.

3. As necessary, specific components are enclosed to maintain the redundancy required for those systems that must function as a consequence of specific piping failure events.

B. Barriers-Shields and Enclosures

Protection requirements are met through the protection afforded by the walls, floors, AND columns, ~~abutments, and foundations~~ in many cases. Where adequate protection does not already exist due to separation, additional barriers, deflectors, or shields are provided as necessary to meet the functional protection requirements. Where compartments, barriers, and structures are required to provide the necessary protection, they are designed to withstand the combined effects of the postulated failure plus normal operating loads plus earthquake loadings. E

C. Piping Restraint Protection

Where adequate protection does not already exist due to separation, barriers or shields, piping restraints are provided as necessary to meet the functional protection requirements. Restraints are not provided when it can be shown that the pipe break would not cause unacceptable damage to essential systems or components.

The design criteria for pipe whip restraints are given in Section ~~3.6.2.3.3.~~ 3.6.2.3.2.5.

D. Facility Response Analyses

An analysis of postulated pipe break events was performed to identify those safety-related systems and components that

6.2.3 Annulus Ventilation System

Question 480.36

a. Our interpretation of the containment system is that there are both a primary and a secondary containment. As such, the analyses outlined in SRP 6.2.3 Rev. 2, including the following, need to be performed:

   1) Pressure and temperature response of the secondary containment to a LOCA in the primary containment

   2) Pressure and temperature response of the annular region between the primary and secondary containments to a high energy line rupture within the secondary containment

b. Regulatory Guide 1.52 specifies use of HEPA filters before and after carbon filters. Provide a justification for the use of a single HEPA filter in the proposed design.

c. Is the annulus ventilation system instrumented to signal, alarm and record pressure drops and flow rates in the control room as specified in Regulatory Guide 1.52?

d. Will the system be tested in accordance with ASME/ANSI N509 and N510 as specified in Regulatory Guide 1.52?

Response 480.36

a. The annulus building pressure analysis is presented in CESSAR-DC Section 6.2.1.8. Pressure and temperature responses of the annulus post LOCA are presented in CESSAR-DC Figures 6.2.1-37 and 6.2.1-38 respectively. The annulus region contains no high energy lines. High energy lines which penetrate the containment and annulus are provided with guard pipes. Therefore, an analysis for a high energy line rupture within the annulus is not required.

b. HEPA filters will be used before and after carbon filters. The post filter reflected in the design is a HEPA filter downs[illegible]m of the carbon filter.

c. Yes, except that flow rates will not be recorded. High and low differential pressure alarms in the control room provide indication of any abnormality in flow rates.

d. Yes, with the following exception to Regulatory Position C.5 of Regulatory Guide 1.52.

HEPA filters will be tested for efficiency, initially at the factory and at the USNRC Quality Assurance Station in accordance with MIL-STD-282.

This response is being incorporated into CESSAR-DC Section 6.2.3. A markup of this section is attached.

RAI 480.36

6.2.3.4.1 **Manufacturer Testing**

The manufacturer will be required to verify by appropriate tests the following:

A. Charcoal and High Efficiency Filters:

Testing in compliance with Regulatory Guide 1.52, with the exception that ← insert 2.

B. Fan:

Certified head and flow characteristics.

6.2.3.4.2 **System Testing and Inspection**

Operational testing will be performed prior to initial startup to demonstrate proper functioning of the system. Testing will include the following:

A. Leak tightness of components and system to be in accordance with ASME N510.

B. System functional test (flow, vacuum pressure, etc.)

Thereafter, periodic (once a year, or during refueling - whichever comes first) tests and inspections will be performed to demonstrate system readiness and operability.

6.2.3.5 Instrumentation Application

The following instrumentation and control functions will be included for the Annulus Ventilation System:

A. The Annulus Ventilation System is activated by the containment spray actuation signal or manual test signal. Upon failure of the designated system to start, the redundant system will be signalled to start. I

B. The signal will actuate the two isolation dampers to the open position. Upon failure of the system to start, power will be cut off and the isolation dampers will close.

C. Air flow will actuate the balancing dampers to maintain the design pressure differential. Loss of air flow will close the vent balancing damper and open the recirculation balancing damper.

d. ← insert 1

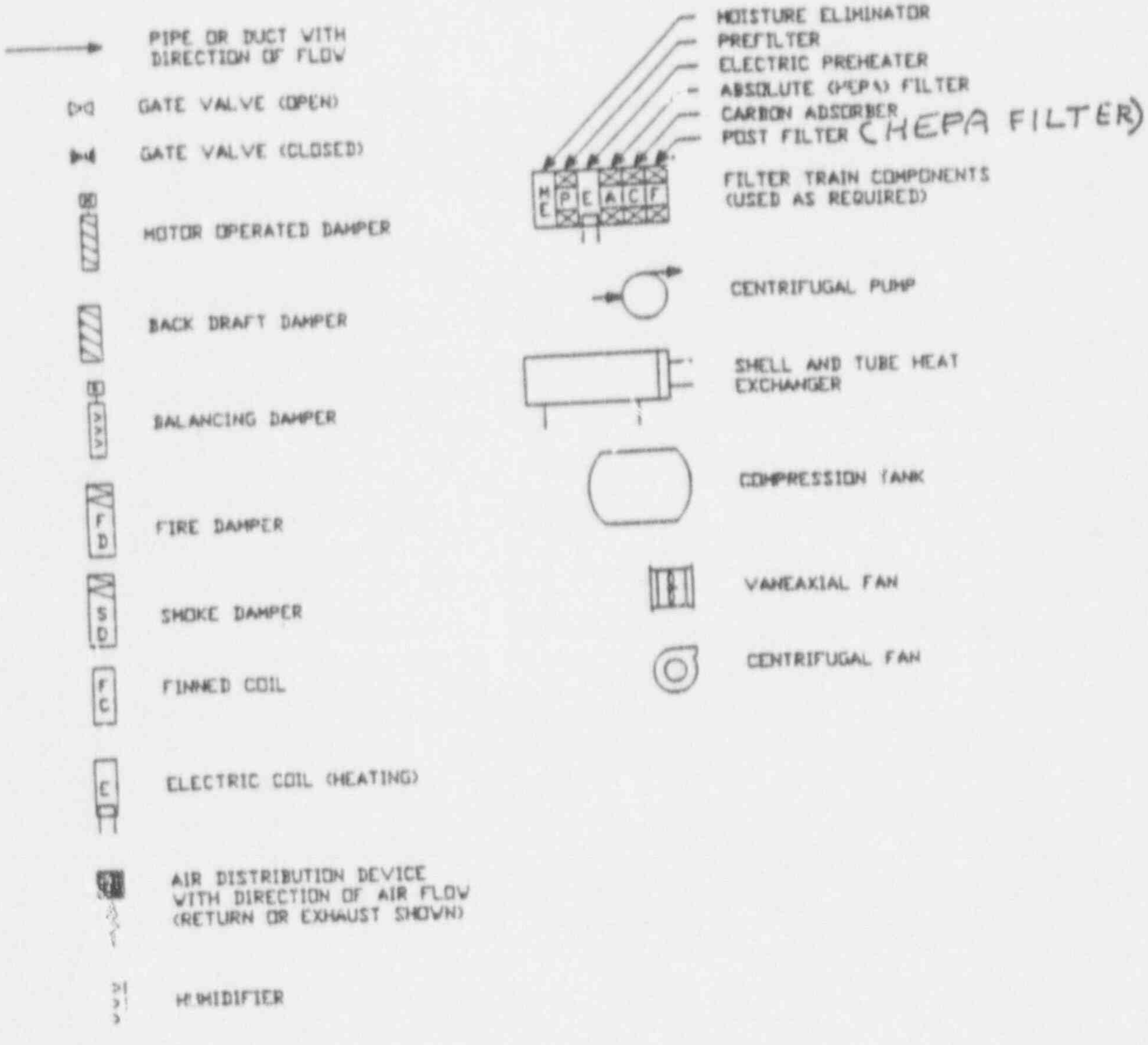
Insert 1 Question 480.36

High and low differential pressure alarms in the control room will provide indication of any abnormality in flow rates.

Insert 2

HEPA filters will be tested for efficiency, initially at the factory and at the USNRC Quality Assurance Station in accordance with MIL-STD-282.

Attachment ALWR-346
RAI 480.36



Amendment I
December 21, 1990

SYSTEM 80+™	GRAPHICAL SYMBOLS FOR AIR FLOW DIAGRAMS	Figure 9.4-1

Question 480.37 (6.2.4)

a. In accordance with SRP 6.2.4 Rev. 2, Item II.6.h, provide the classification of all systems that penetrate the containment as either essential or non-essential.

b. In accordance with SRP 6.2.4 Rev. 2, Item II.6.1, provide information on the diversity in the parameters sensed for the initiation of containment isolation to satisfy GDC 54.

c. In accordance with SRP 6.2.4 Branch Technical Position Item 1.g, provide information on the provisions which have been made to ensure that the containment purge isolation valve closure will not be prevented by debris which could potentially become entrained in the escaping air and steam.

d. In accordance with SRP 6.2.4 Branch Technical Position Item 5, provide an analysis of the radiological consequences of a LOCA, taking into account the possibility of open purge valves. The source term used should be based on a calculation under the terms of Appendix K to determine the extent of fuel failure and the concomitant release of fission products, and the fission-product activity in the primary coolant. The volume of the containment in which fission products are mixed should be justified, and the fission products from the above sources should be assumed to be released through the open purge valves during the maximum interval required for valve closure.

Response 480.37

a. CESSAR-DC, Table 6.2.4-1 specifies the actuation signals for the containment isolation valves. All containment isolation valves which are used for accident mitigation or safe shutdown are automatically closed by a Containment Isolation Actuation Signal (CIAS) except RCP seal injection, component cooling water to the RCPs, and locked close isolation valves. See response to RAI 730.11 (b) for the basis for this arrangement.

   Regulatory Guide 1.141 does not currently contain guidance on essential/non-essential classifications. However, the criteria above meet the intent of the classifications.

b. The CIAS is initiated by diverse sensed parameters, pressurizer pressure and containment pressure. Signal generation and the input parameters for the CIAS are discussed in CESSAR-DC, Section 7.3, Engineered Safety Features Actuation System.

Response 480.37 (Cont'd)

c. The requirement that containment purge isolation valve closure will not be prevented by debris which could become entrained in escaping air and steam will be added to CESSAR-DC, Section 9.4.6.3. The proposed revision is attached.

d. Response to be provided by ABB-CE.

Each Containment Purge Ventilation System supply and exhaust penetration through the containment vessel is equipped with two normally closed isolation valves, each connected to separate control trains. A failure in one train will not prevent the remaining isolation valve from providing the required isolation capability. The isolation valves and containment penetrations are the only portions of the Containment Purge Ventilation System that are engineered safety features.

Insert A

Redundant containment isolation valves are designed, constructed, and tested in accordance with ASME Section III, Class 2. The valves are leak-tested periodically to verify acceptability of seat leakage. Valves are designed to fail closed in the event of loss of power or loss of instrument air. All four Containment Purge isolation valves receive a containment isolation signal to close; however, the High Volume Purge System will not be open during power operation. I

The containment purge exhaust filter train is designed to meet the intent of Regulatory Guide 1.52. Ductwork from the containment penetration to the filter train will be low-leakage design.

The containment purge exhaust system is isolated on high radiation or high relative humidity signals. Relative humidity is controlled and monitored upstream of the containment purge exhaust filter trains.

9.4.6.4 Inspection and Testing Requirements

Performance characteristics of the containment ventilation system are verified through qualification testing of essential components as follows:

A. One of four containment recirculation fans is tested in accordance with AMCA standards to assure fan characteristics performance curves. All other fans are rated in accordance with AMCA standards. E

B. Heating and cooling coils are leak-tested with air, or hydrostatically, to ensure integrity. Coils are rated in accordance with ARI standards.

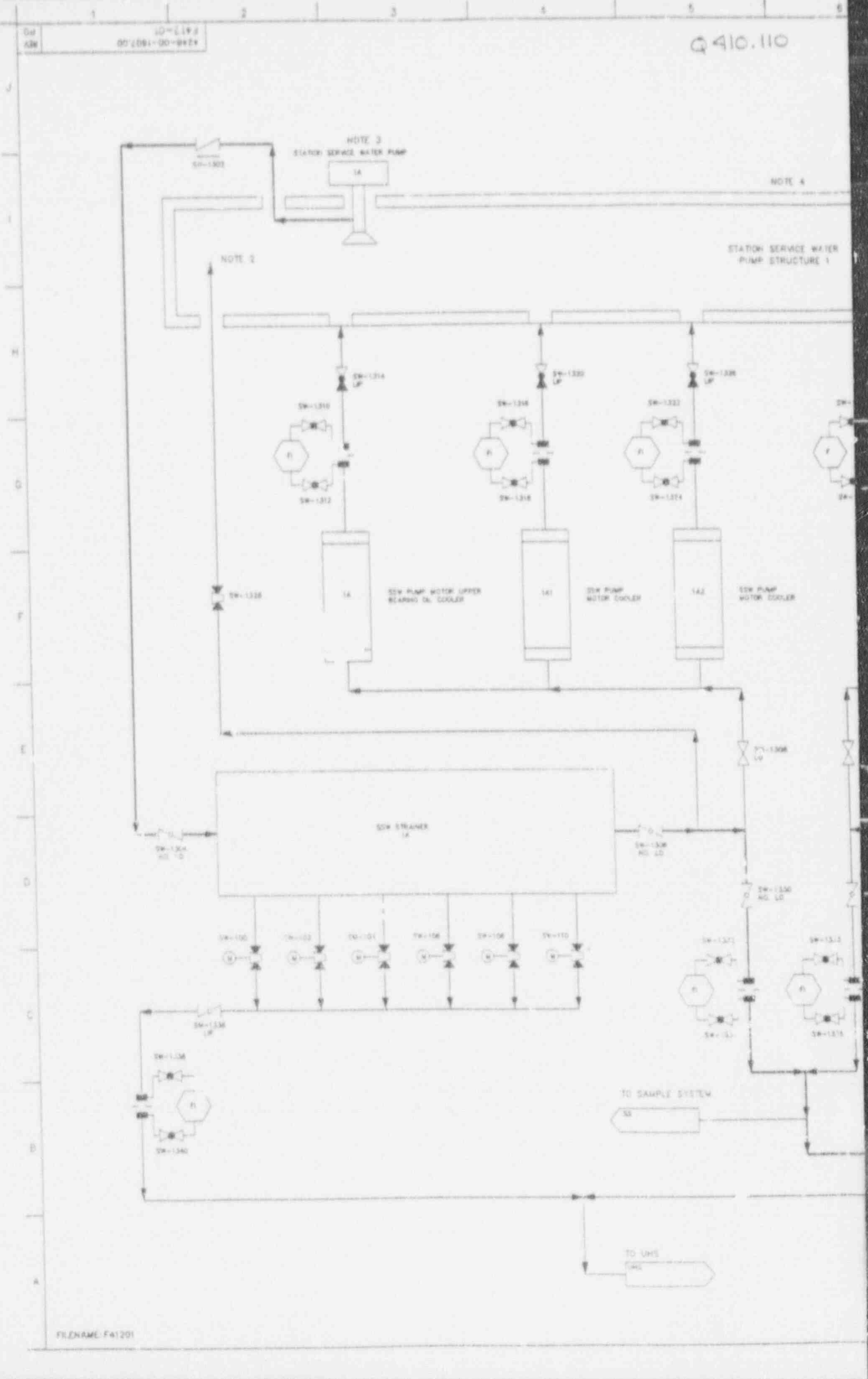
C. HEPA filters are manufactured and tested prior to installation in accordance with MIL-F-51068. HEPA filters in the containment purge exhaust system are periodically tested to verify removal efficiency. Carbon absorbers are periodically tested to verify required removal efficiency based on the dose assessment.

Attachment to CESSAR-DC (Page 9.4-31)

Insert A

Containment purge isolation valve closure will not be prevented by debris which could become entrained in the escaping air and steam.

Q410.110



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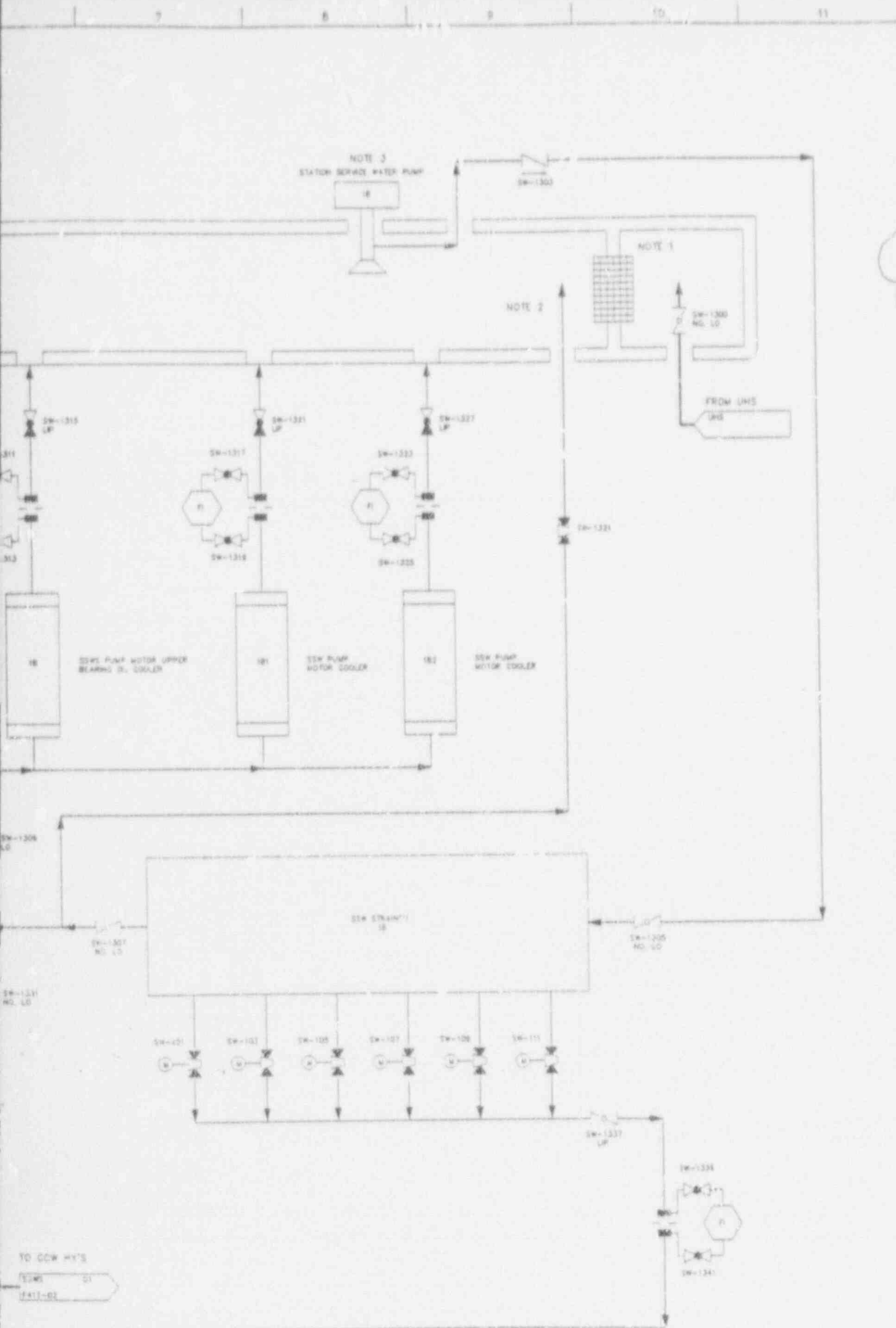

NOTES:

1. SCREEN
2. DRAIN LINE ENDS ABOVE PUMP STRUCTURE WATER LEVEL
3. AUTO START OF IDLE PUMP ON LOW DISCHARGE PRESSURE SIGNAL FROM THE OPERATING PUMP
4. PUMP AND THE ASSOCIATED CHECK VALVE, STRAINER, AND ISOLATION VALVES ARE INSIDE THE STATION SERVICE WATER PUMP STRUCTURE
5. All of the equipment, piping, and valves on this sheet are Safety Class 3.

SI APERTURE CARD

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9201310151-01

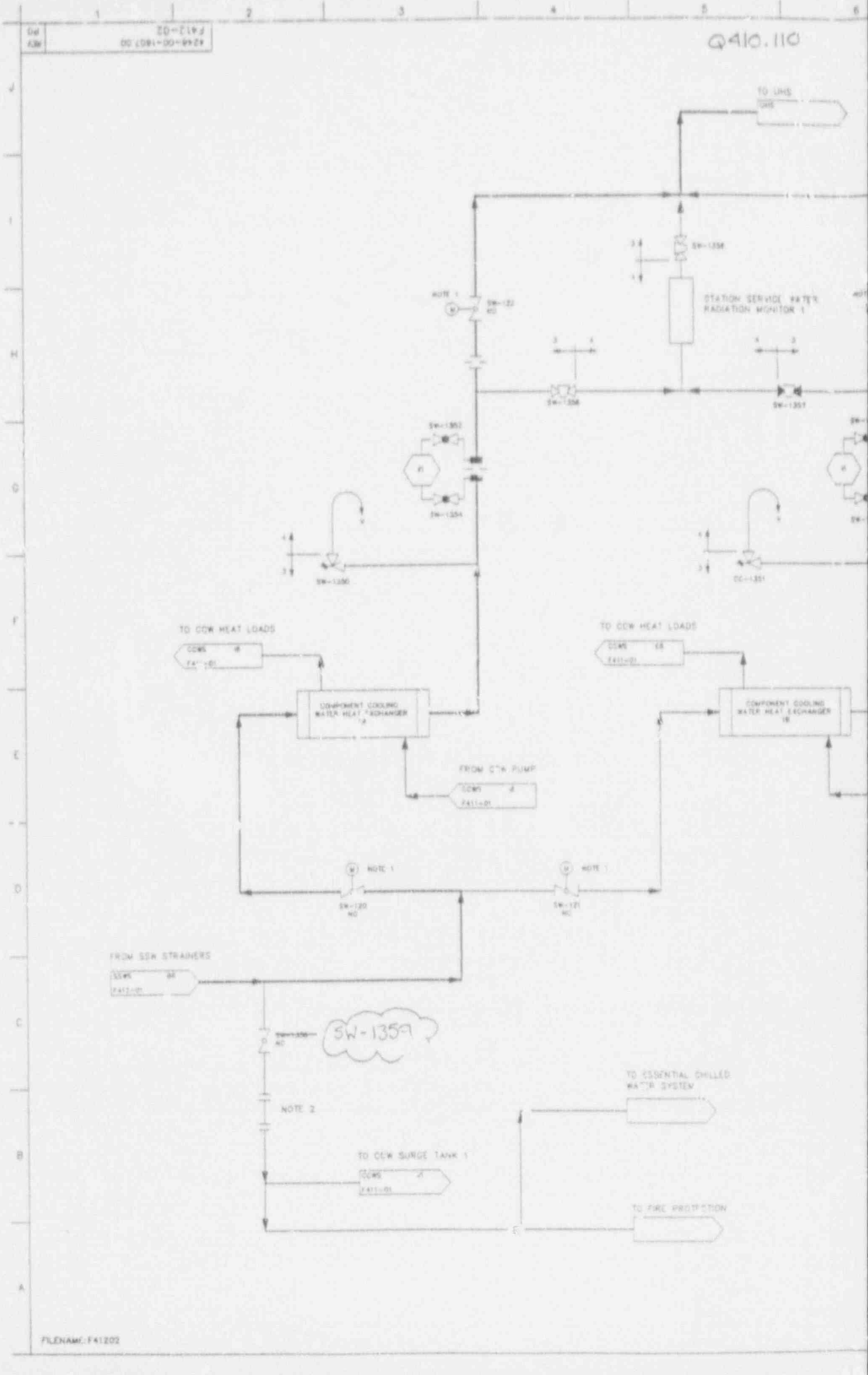
Amendment I
December 21, 1990

SYSTEM 80+™

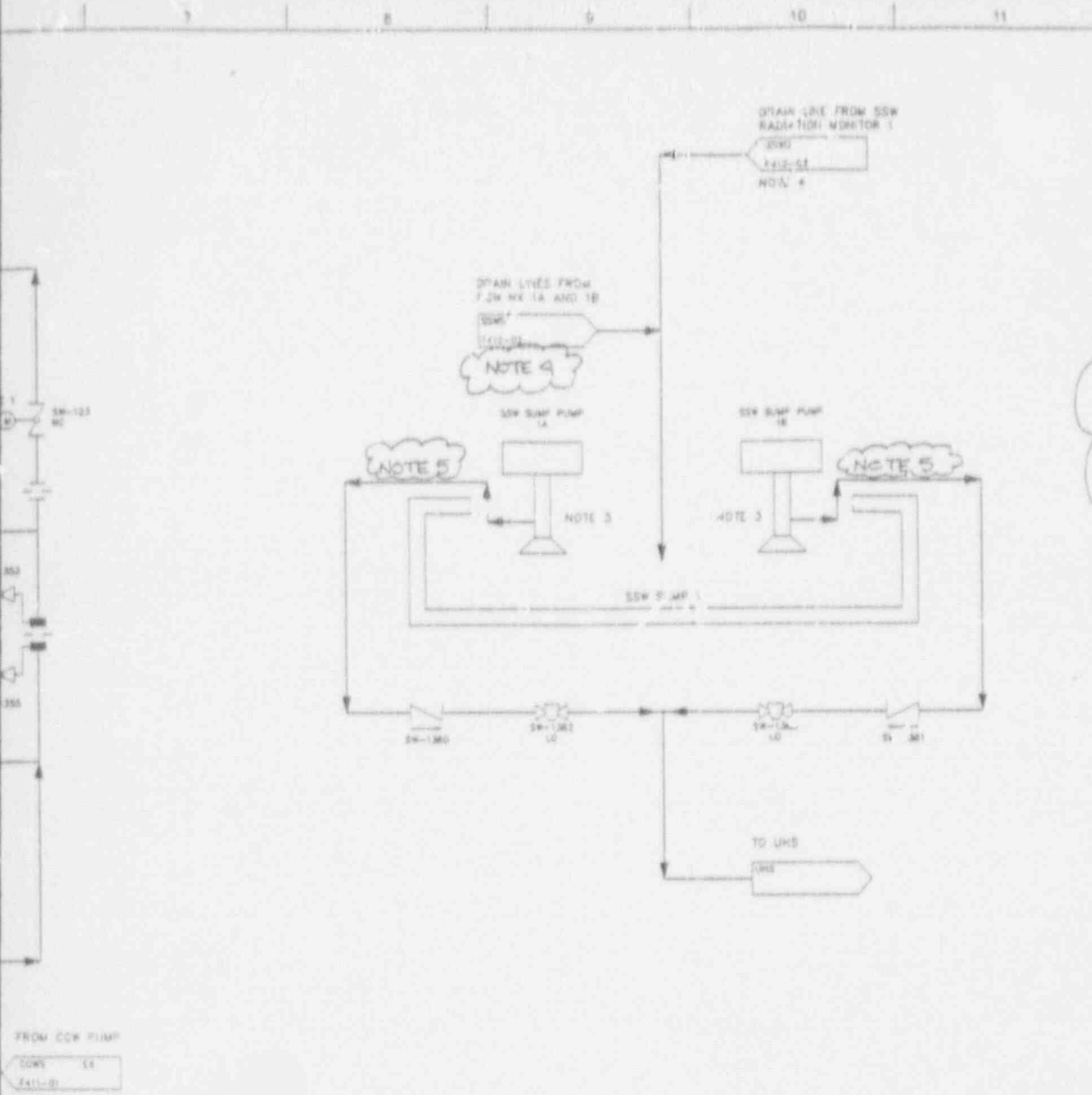
STATION SERVICE WATER SYSTEM FLOW DIAGRAM

Figure 9.2.1-1

Sheet 1 of 4



Q410.110
TO UHS
STATION SERVICE WATER RADIATION MONITOR 1
SW-1352
SW-1354
SW-1350
TO CCW HEAT LOADS
COMPONENT COOLING WATER HEAT EXCHANGER 1A
COMPONENT COOLING WATER HEAT EXCHANGER 1B
FROM CCW PUMP
NOTE 1
SW-120 NO
SW-121 NC
FROM SSW STRAINERS
SW-1359
NOTE 2
TO CCW SURGE TANK 1
TO ESSENTIAL CHILLED WATER SYSTEM
TO FIRE PROTECTION
FILENAME: F41202



NOTES:

1. OPERABLE FROM THE CONTROL ROOM
2. SPOOL PIECE NORMALLY REMOVED
3. PUMPS ARE ALTERNATED
4. EQUIPMENT DRAIN LINES WILL BE LOCATED AFTER EQUIPMENT HAS BEEN PURCHASED. Equipment drain lines are Safety Class 4.
5. The sump pumps and associated piping and valves are Safety Class 4.

SI APERTURE CARD

Also Available On Aperture Card

9201310151-02

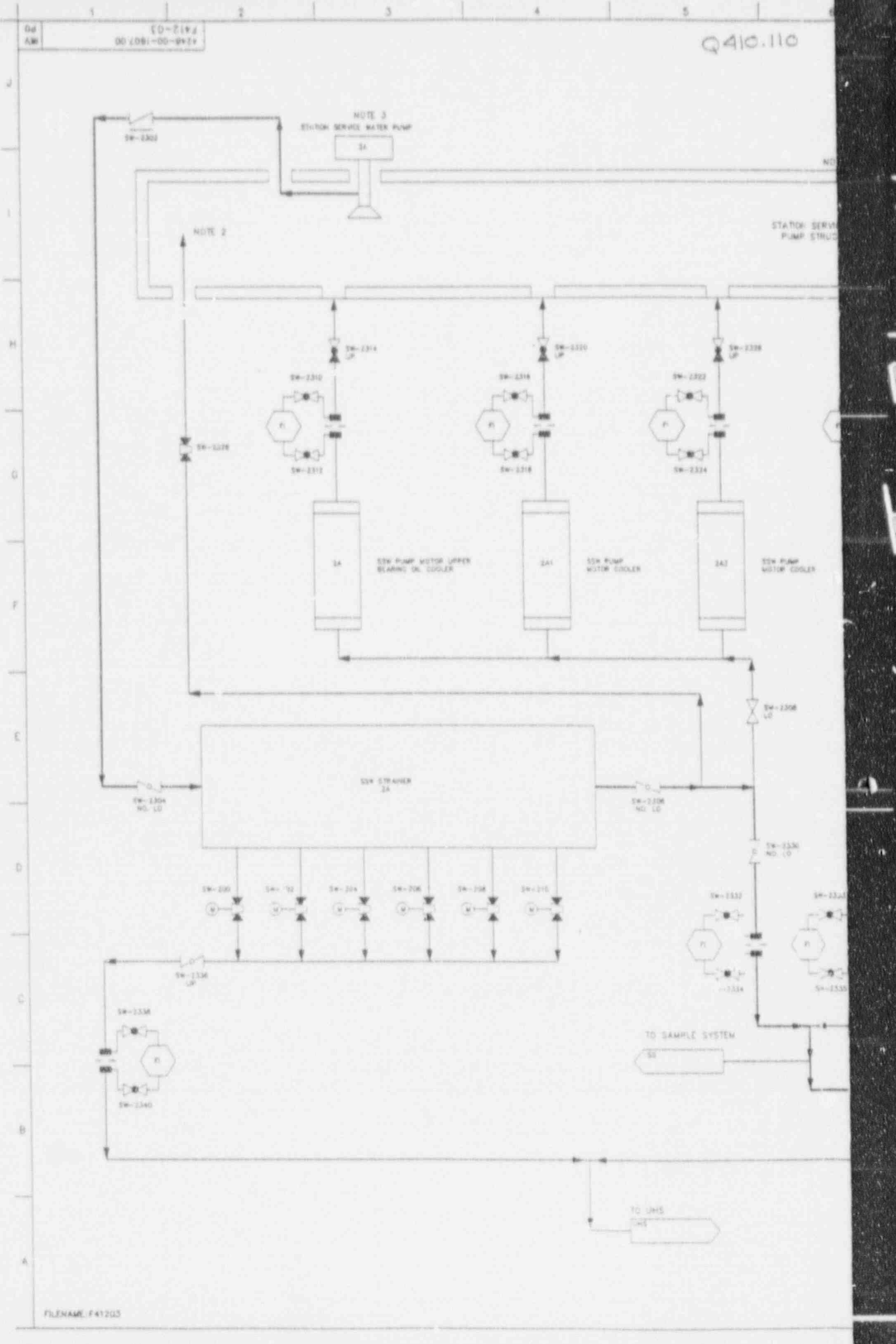
Amendment I
December 21, 1990

SYSTEM 80+™

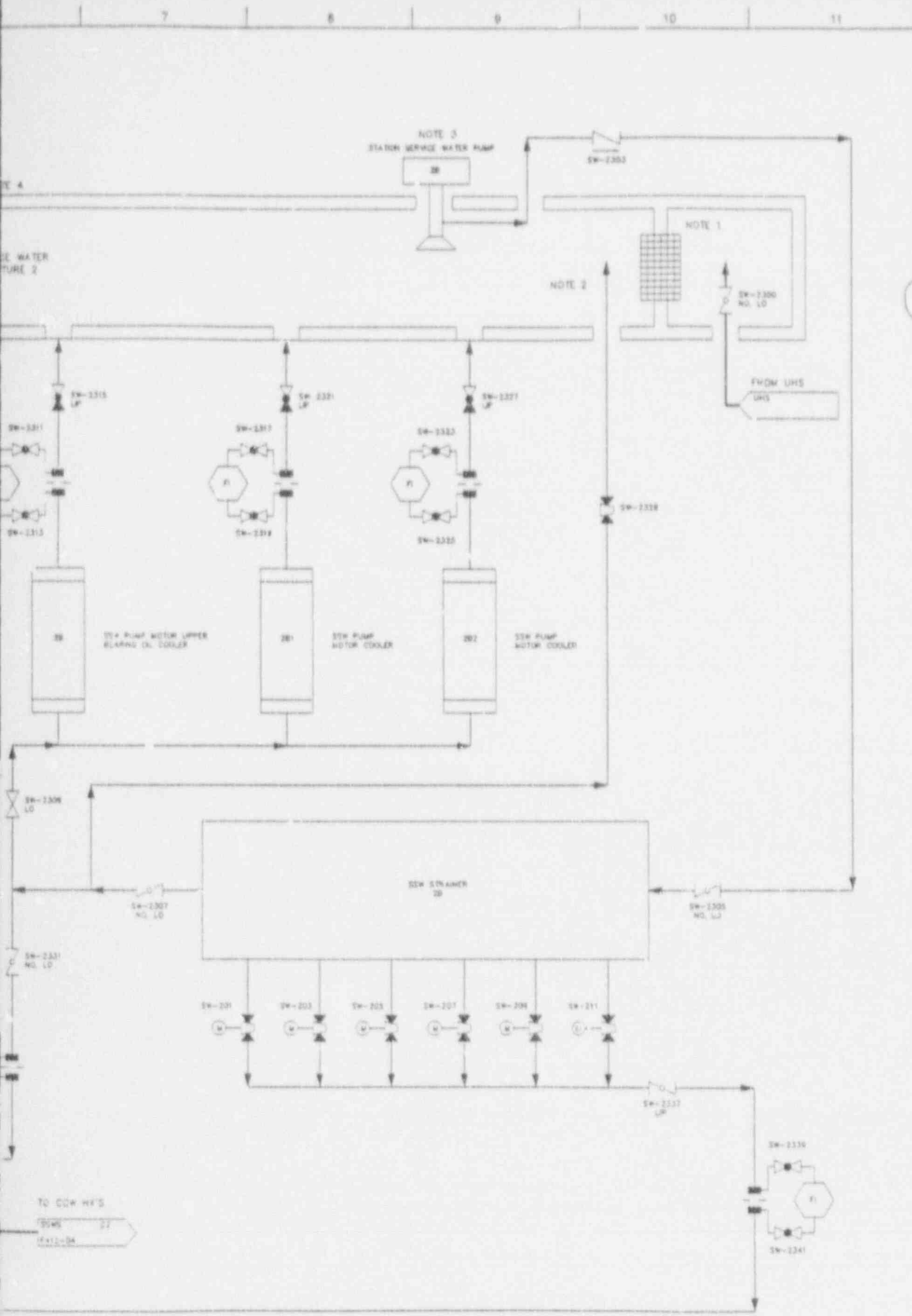
STATION SERVICE WATER SYSTEM FLOW DIAGRAM

Figure 9.2.1-1

Sheet 2 of 4



Q410.110
F412-03
4248-00-1907.00
NOTE 3
STATION SERVICE WATER PUMP
2A
SW-2302
NOTE 2
STATION SERVI
PUMP STRUC
SW-2314 LP
SW-2320 LP
SW-2328 LP
SW-2310
SW-2312
SW-2316
SW-2318
SW-2322
SW-2324
SW-2326
PI
2A
SSW PUMP MOTOR UPPER BEARING OIL COOLER
2A1
SSW PUMP MOTOR COOLER
2A2
SSW PUMP MOTOR COOLER
SW-2308 LO
SSW STRAINER 2A
SW-2304 NO. LO
SW-2306 NO. LO
SW-2330 NO. LO
SW-200
SW-204
SW-206
SW-208
SW-210
SW-2332
SW-2334
SW-2335
SW-2336 LP
SW-2338
SW-2340
TO SAMPLE SYSTEM
SS
TO UHS
UHS
FILENAME: F41203



NOTES:

1. SCREEN
2. DRAIN LINE ENDS ABOVE PUMP STRUCTURE WATER LEVEL
3. AUTO START OF IDLE PUMP ON LOW DISCHARGE PRESSURE SIGNAL FROM THE OPERATING PUMP
4. PUMP AND ASSOCIATED CHECK VALVE, STRAINER, AND ISOLATION VALVES ARE INSIDE THE STATION SERVICE WATER PUMP STRUCTURE
5. All of the equipment, piping, and valves on this sheet are Safety Class 3.

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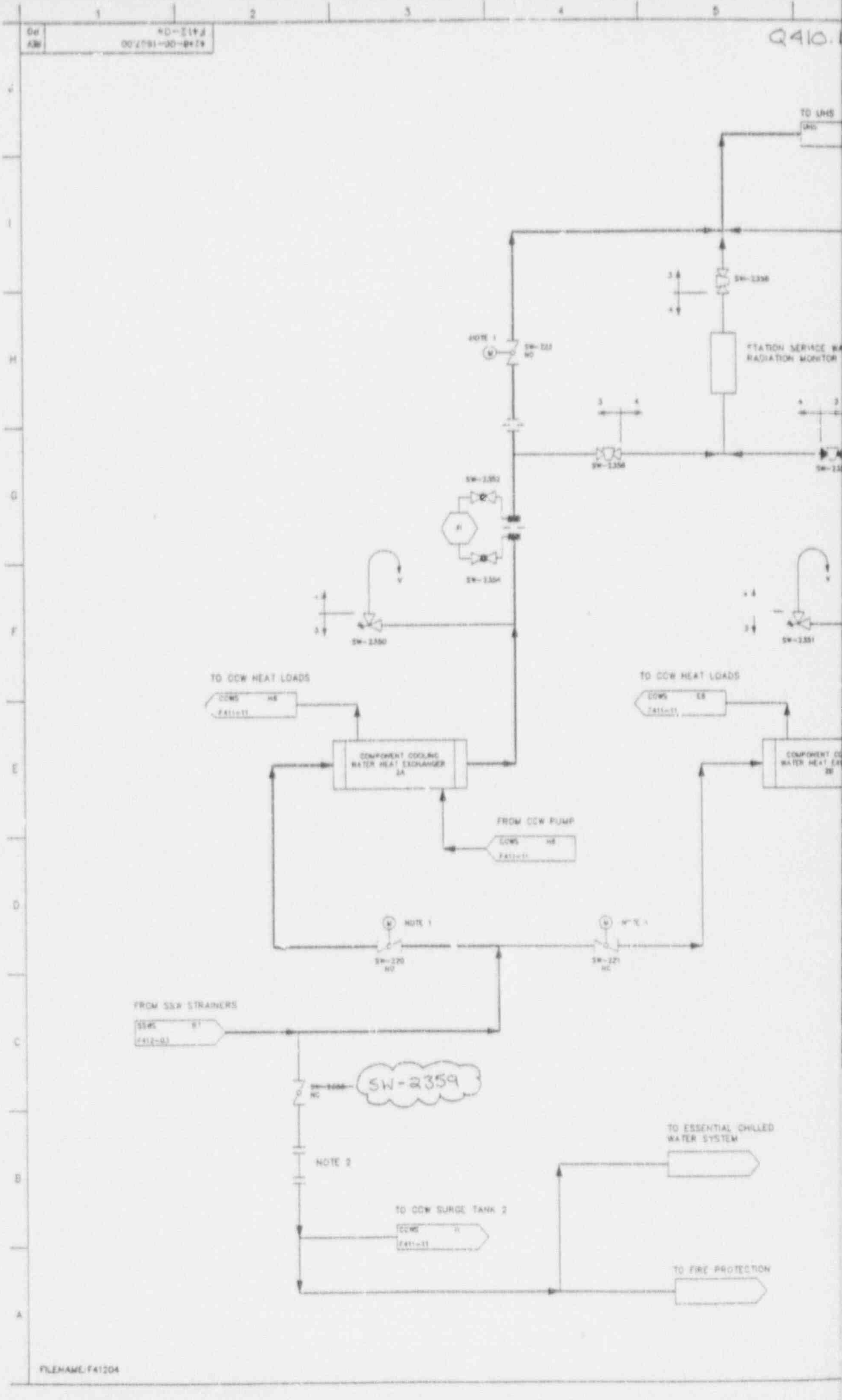
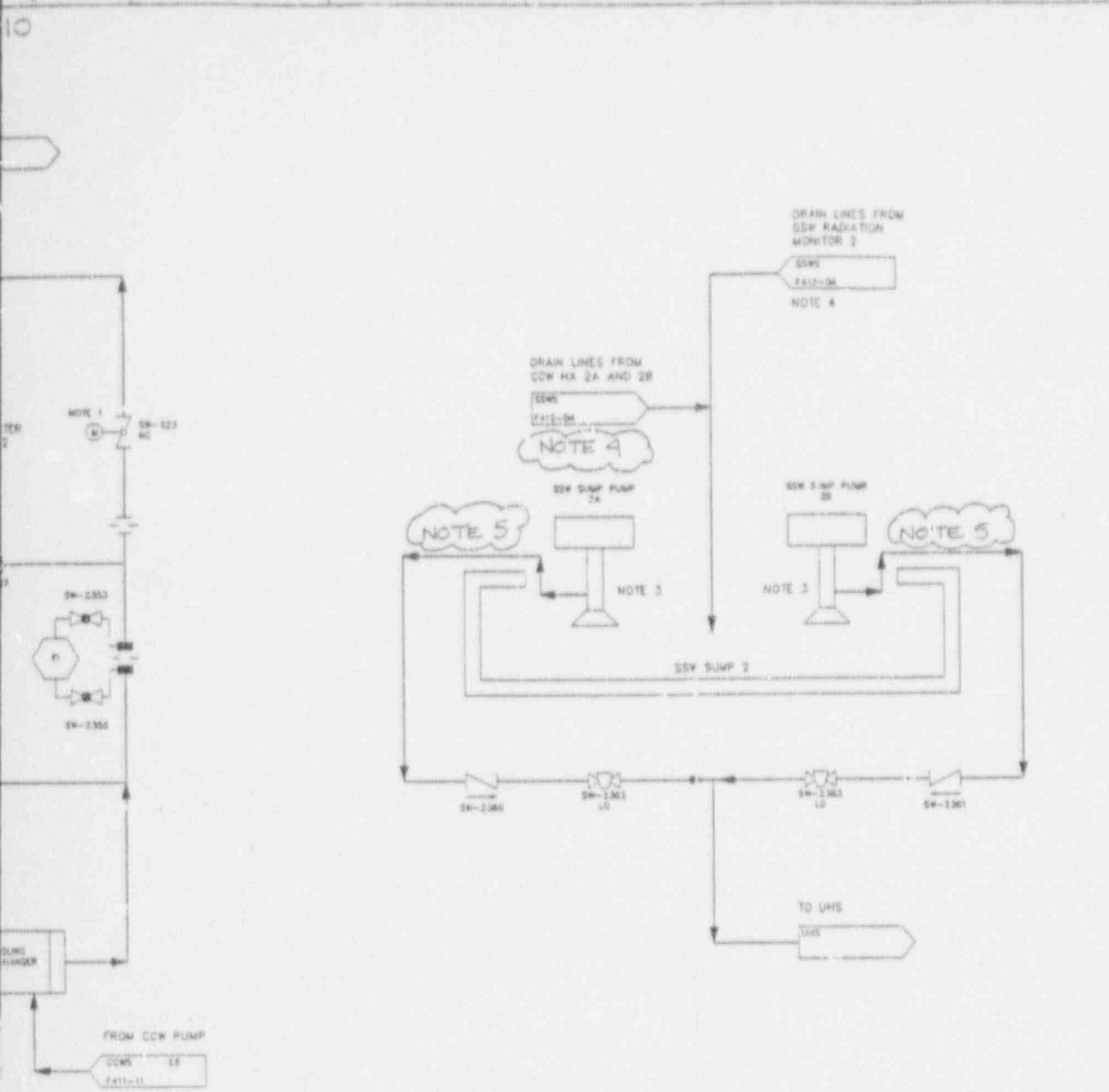
SYSTEM 80+™

STATION SERVICE WATER SYSTEM FLOW DIAGRAM

Figure 9.2.1-1

Sheet 3 of 4


Q410.
TO UHS
STATION SERVICE WA
RADIATION MONITOR
NOTE 1
SW-2352
SW-2354
SW-2350
SW-2351
SW-2356
TO CCW HEAT LOADS
TO CCW HEAT LOADS
COMPONENT COOLING WATER HEAT EXCHANGER 2A
FROM CCW PUMP
NOTE 1
SW-220
SW-221
FROM SSW STRAINERS
SW-2359
NOTE 2
TO ESSENTIAL CHILLED WATER SYSTEM
TO CCW SURGE TANK 2
TO FIRE PROTECTION
FILENAME: F41204



NOTES:

1. OPERABLE FROM THE CONTROL ROOM
2. SPOOL PIECE NORMALLY REMOVED
3. PUMPS ARE ALTERNATED
4. EQUIPMENT DRAIN LINES WILL BE LOCATED AFTER EQUIPMENT HAS BEEN PURCHASED. Equipment drain lines are Safety Class 4.
5. The sump pumps and associated piping and valves are Safety Class 4.

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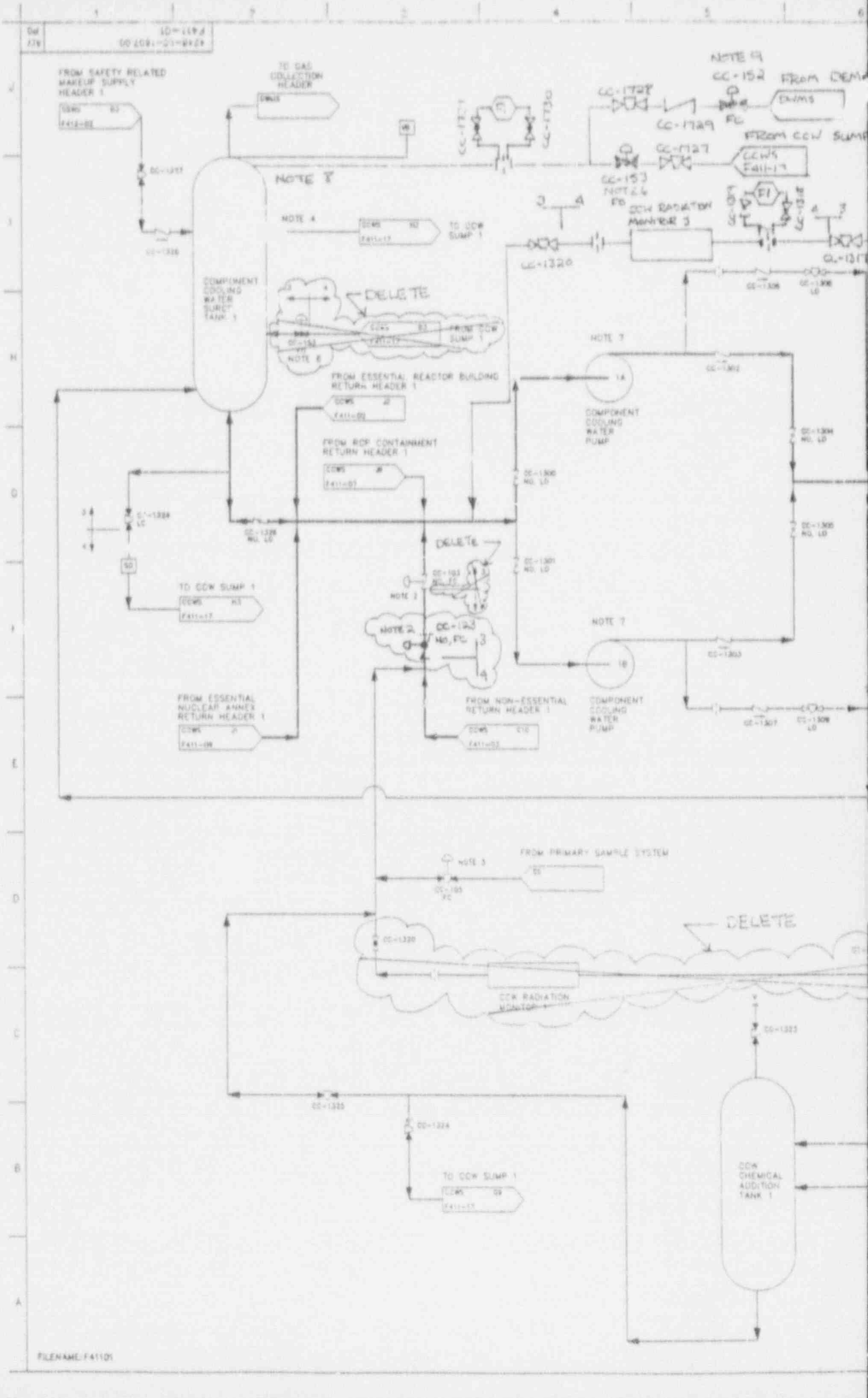
SYSTEM 80+™

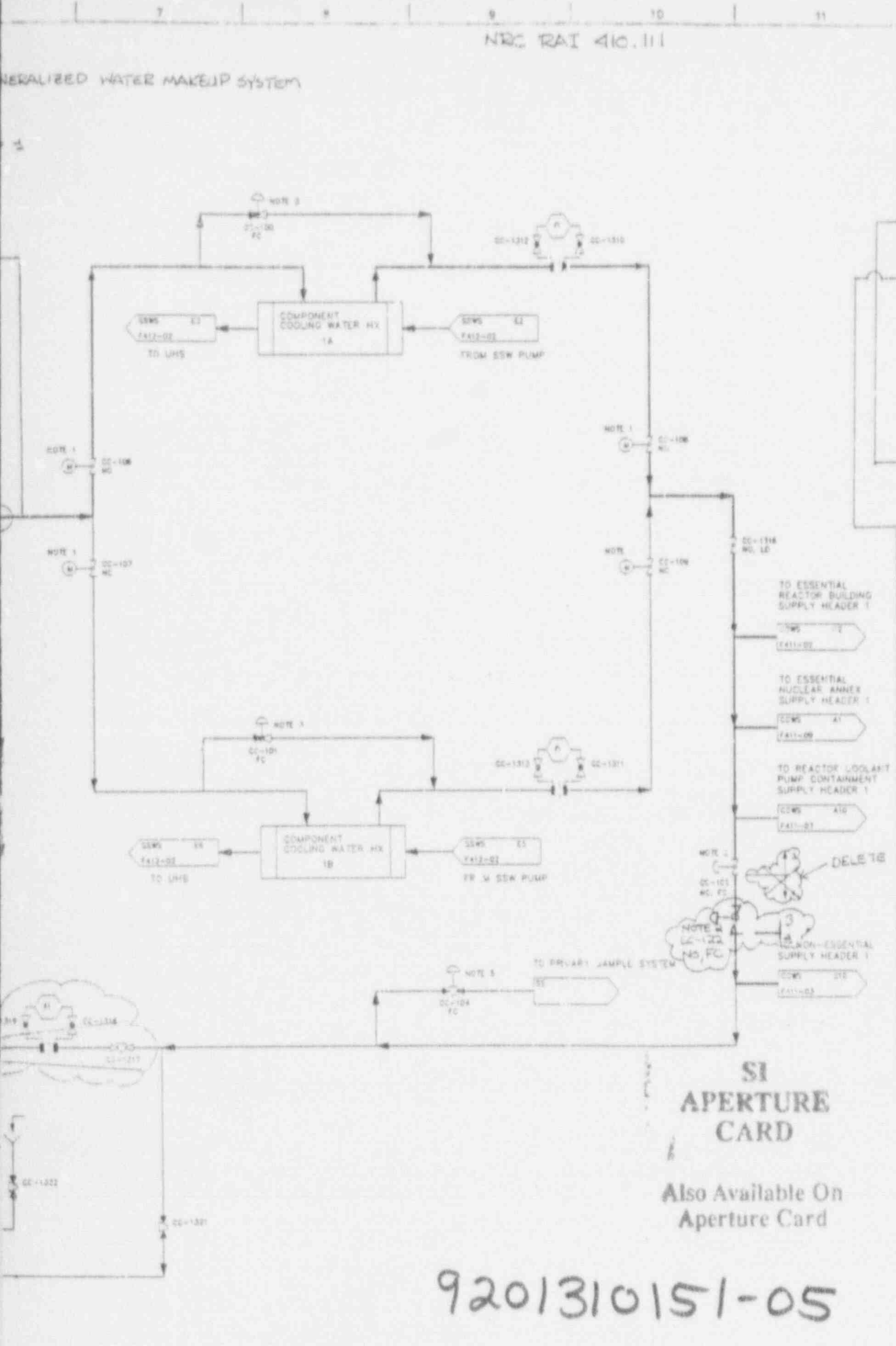
STATION SERVICE WATER SYSTEM
FLOW DIAGRAM

Figure 9.2.1-1

Sheet 4 of 4


FROM SAFETY RELATED MAKEUP SUPPLY HEADER 1
TO GAS COLLECTION HEADER
NOTE 9
CC-152
FROM DEMI
CC-1728
CC-1729
CC-1730
DWMS
FROM CCW SUMP
CC-1727
CCWS
F411-17
CC-153
NOTE 6
NOTE 8
CC-1317
NOTE 4
TO CCW SUMP 1
CC-1320
CCW RADIATION MONITOR 3
COMPONENT COOLING WATER SURGE TANK 1
DELETE
FROM CCW SUMP 1
NOTE 7
FROM ESSENTIAL REACTOR BUILDING RETURN HEADER 1
COMPONENT COOLING WATER PUMP
FROM RCP CONTAINMENT RETURN HEADER 1
NOTE 2
CC-123
NO, FC
TO CCW SUMP 1
FROM ESSENTIAL NUCLEAR ANNEX RETURN HEADER 1
FROM NON-ESSENTIAL RETURN HEADER 1
COMPONENT COOLING WATER PUMP
FROM PRIMARY SAMPLE SYSTEM
NOTE 3
CCW RADIATION MONITOR 1
CCW CHEMICAL ADDITION TANK 1
TO CCW SUMP 1
FILENAME: F41101

NRC RAI 410.111



NOTES:

1. OPERABLE FROM THE CONTROL ROOM
2. CLOSES ON SIAS AND ~~LOW~~ LOW-LOW CCW SURGE TANK LEVEL. OPEN/CLOSE OPERATION
3. CLOSES ON SIAS; CONTROLLED OFF THE OUTLET TEMPERATURE OF THE CCW SIDE OF THE CCW HEAT EXCHANGER
4. OVERFLOW LINE IS NON-SAFETY CLASS ~~4~~.
5. VALVE CC-104 AND CC-103 TO BE OPERABLE FROM THE SAMPLE ROOM
6. ~~OPENS ON PREDETERMINED SURGE TANK LEVELS, CLOSES ON NORMAL SURGE TANK LEVEL. MANUAL OVERRIDE IS PROVIDED~~
7. IDLE PUMP AUTOMATICALLY STARTS ON LOW CCW PUMP DIFFERENTIAL PRESSURE

THE OVERFLOW LINE CONNECTION TO THE SURGE TANK IS ABOVE THE NORMAL WATER LEVEL IN THE TANK.

8. THIS CONNECTION TO THE SURGE TANK IS ABOVE THE NORMAL WATER LEVEL IN THE TANK.

9. OPENS ON A PREDETERMINED SURGE TANK LEVEL; CLOSES ON NORMAL SURGE TANK LEVEL; MANUAL OVERRIDE IS PROVIDED IN CONTROL ROOM.

6. OPENS ON PREDETERMINED SUMP HIGH LEVEL; CLOSES ON A PREDETERMINED SUMP LOW LEVEL OR NORMAL SURGE TANK LEVEL; MANUAL OVERRIDE IS PROVIDED.

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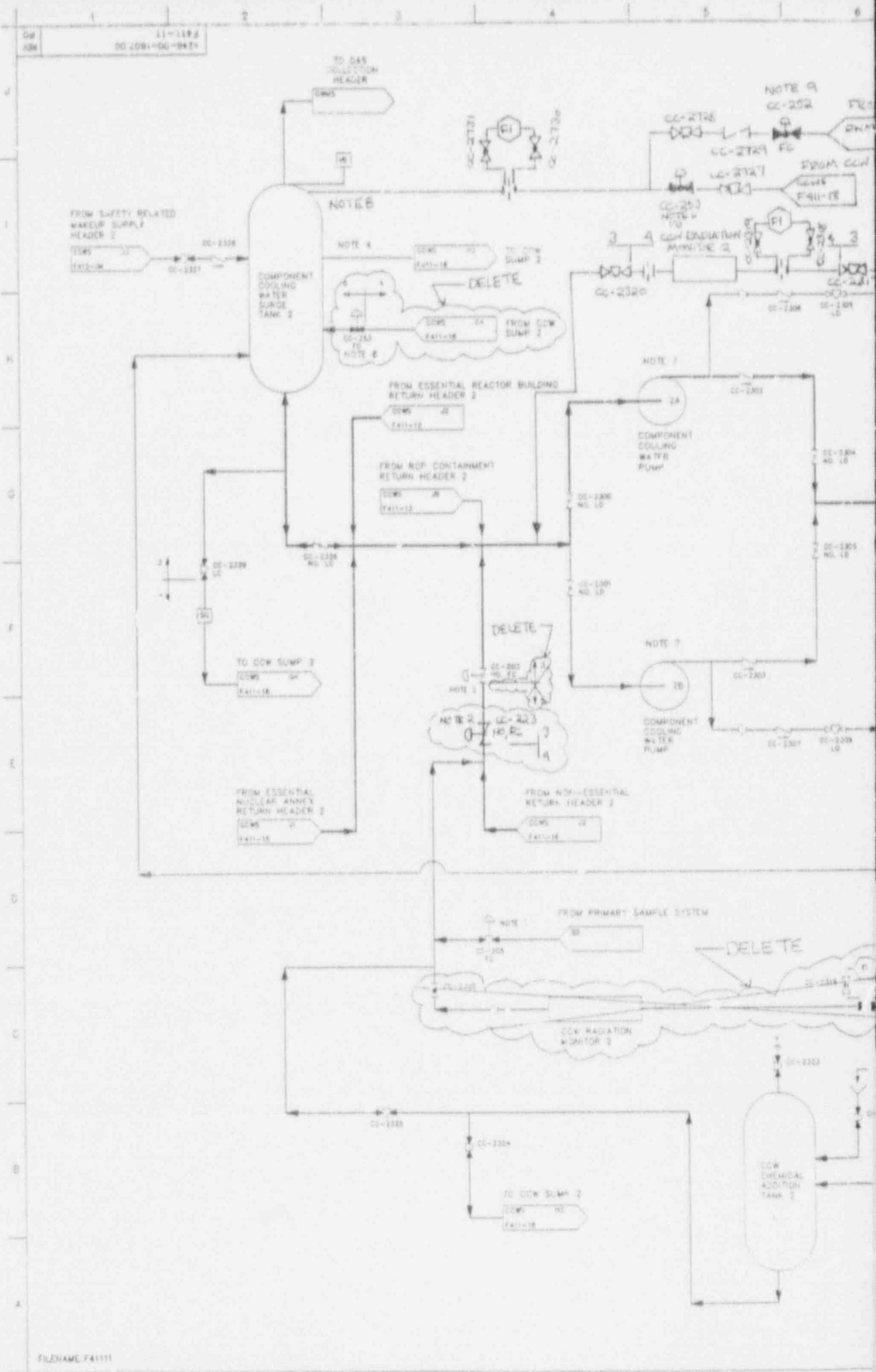
System 80+™	COMPONENT COOLING WATER SYSTEM FLOW DIAGRAM	Figure 9.2.2-1

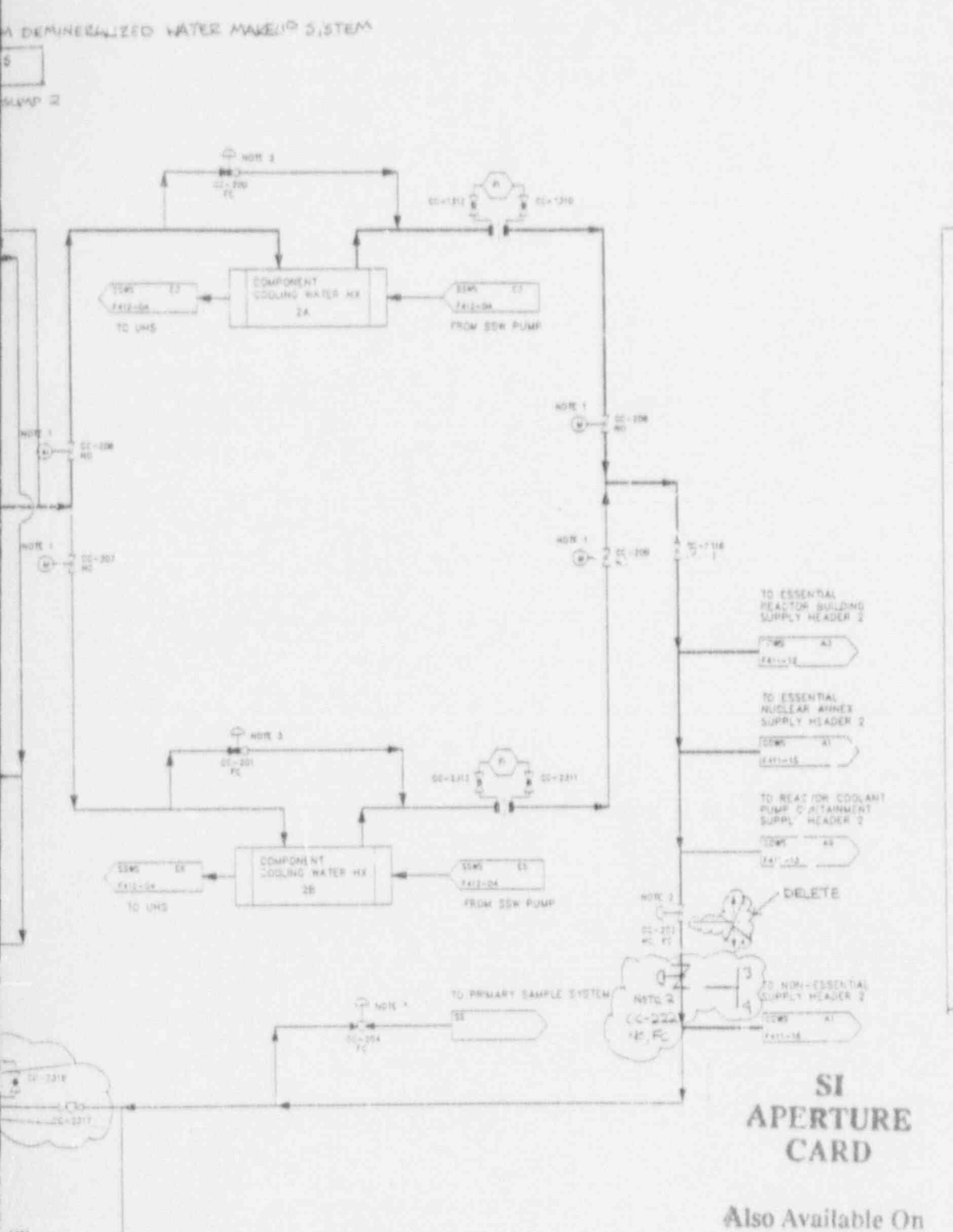
Sheet 1 of 19



TO DAS COLLECTION HEADER
NOTE 9
CC-252
CC-2728
CC-2729
CC-2727
FROM CCW
F411-13
NOTE 8
CC-253
CCW RADIATION MONITOR 2
CC-2320
FROM SAFETY RELATED MAKEUP SUPPLY HEADER 2
CC-2328
CC-2327
NOTE 4
TO CCW SUMP 2
COMPONENT COOLING WATER SURGE TANK 2
DELETE
FROM CCW SUMP 2
NOTE 7
CC-2302
COMPONENT COOLING WATER PUMP
FROM ESSENTIAL REACTOR BUILDING RETURN HEADER 2
FROM RCP CONTAINMENT RETURN HEADER 2
CC-2300 NO. LO
CC-2304 NO. LO
CC-2305 NO. LO
CC-2301 NO. LO
CC-2326 NO. LO
CC-2329 LO
TO CCW SUMP 2
NOTE 7
CC-2303
COMPONENT COOLING WATER PUMP
CC-2307
DELETE
NOTE 2
CC-223
FROM ESSENTIAL NUCLEAR ANNEX RETURN HEADER 2
FROM NON-ESSENTIAL RETURN HEADER 2
FROM PRIMARY SAMPLE SYSTEM
CC-205
DELETE
CCW RADIATION MONITOR 2
CC-2323
CC-2333
CC-2324
TO CCW SUMP 2
CCW CHEMICAL ADDITION TANK 2
FILENAME: F41111

7 8 9 10 11

NRC RAI 410.111



NOTES:

1. OPERABLE FROM THE CONTROL ROOM
2. CLOSES ON SIAS OR ~~LOW~~ LOW-LOW SURGE TANK LEVEL. OPEN/CLOSE OPERATION
3. CLOSES ON SIAS; CONTROLLED OFF THE OUTLET TEMPERATURE OF THE CCW SIDE OF THE CCW HEAT EXCHANGER
4. OVERFLOW LINE IS NON-SAFETY CLASS 4.
5. VALVES CC-204 AND CC-205 TO BE OPERABLE FROM THE SAMPLE ROOM
6. OPENS ON PREDETERMINED ~~SURGE TANK LEVEL; CLOSES ON NORMAL SURGE TANK LEVEL. MANUAL~~ OVERRIDE IS PROVIDED
7. IDLE PUMP AUTOMATICALLY STARTS ON LOW CCW PUMP DIFFERENTIAL PRESSURE

THE OVERFLOW LINE CONNECTION TO THE SURGE TANK IS ABOVE THE NORMAL WATER LEVEL IN THE TANK.

8. THIS CONNECTION TO THE SURGE TANK IS ABOVE THE NORMAL WATER LEVEL IN THE TANK.

9. OPENS ON A PREDETERMINED SURGE TANK LEVEL; CLOSES ON NORMAL SURGE TANK LEVEL; MANUAL OVERRIDE IS PROVIDED IN CONTROL ROOM.

6. OPENS ON ~~PREDETERMINED~~ PREDETERMINED SUMP HIGH LEVEL; CLOSES ON A PREDETERMINED SUMP LOW LEVEL OR NORMAL SURGE TANK LEVEL; MANUAL OVERRIDE IS PROVIDED.

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9201310151-06

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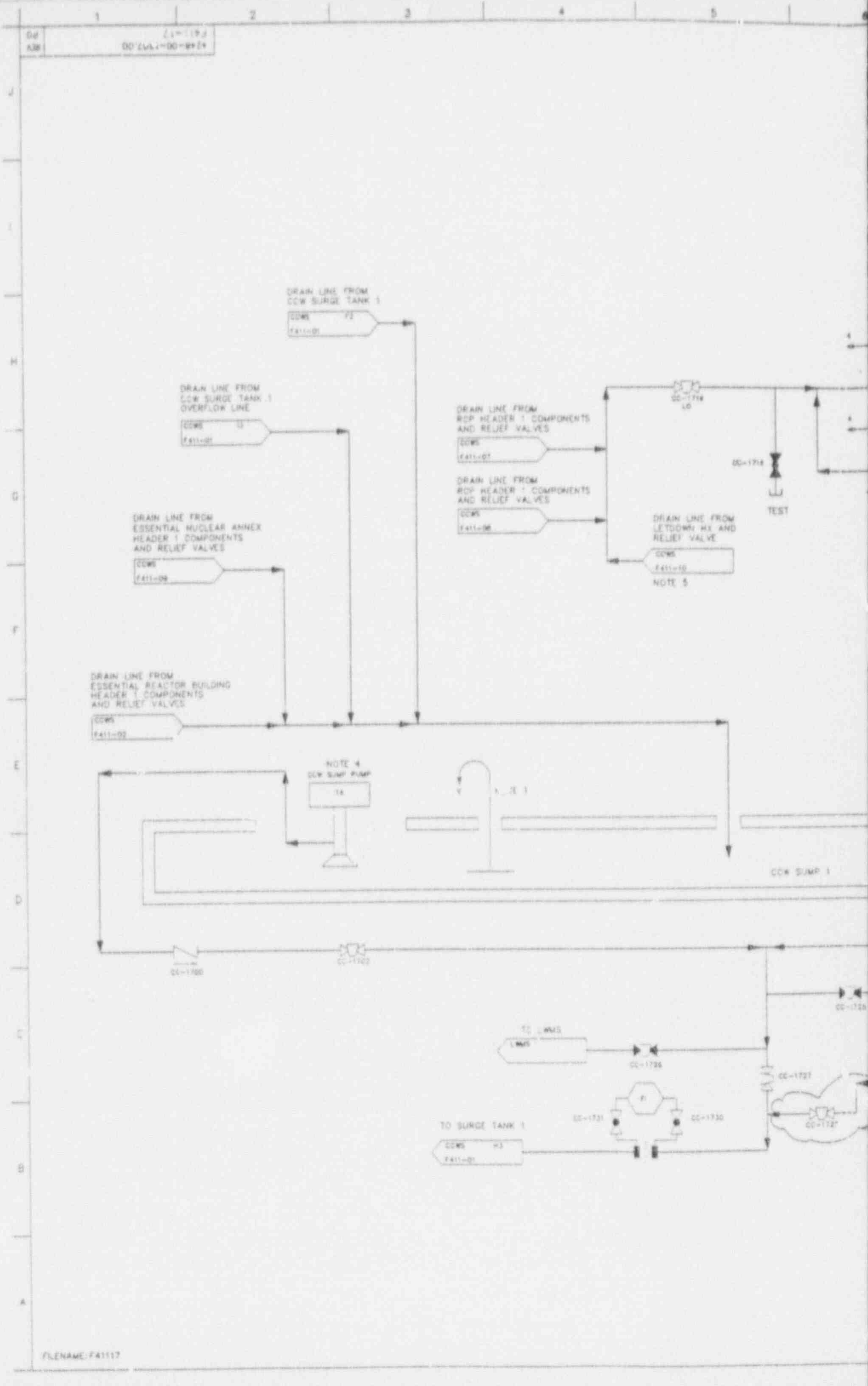
SYSTEM 80+™

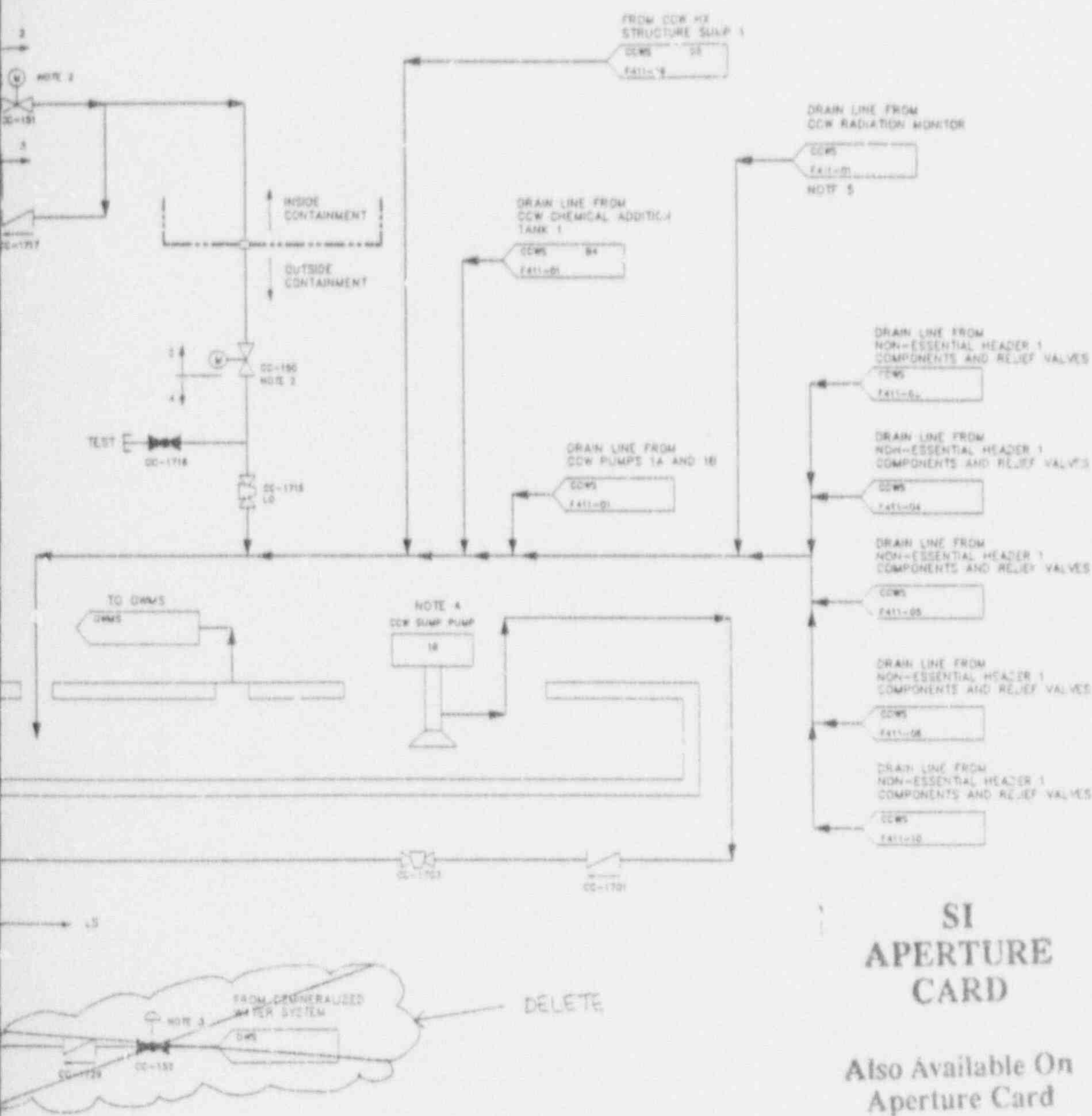
COMPONENT COOLING WATER SYSTEM FLOW DIAGRAM

Figure 9.2.2-1



DRAIN LINE FROM
CCW SURGE TANK 1
CCWS
F411-01
DRAIN LINE FROM
CCW SURGE TANK 1
OVERFLOW LINE
CCWS
F411-01
DRAIN LINE FROM
RCP HEADER 1 COMPONENTS
AND RELIEF VALVES
CCWS
F411-07
DRAIN LINE FROM
RCP HEADER 1 COMPONENTS
AND RELIEF VALVES
CCWS
F411-08
DRAIN LINE FROM
ESSENTIAL NUCLEAR ANNEX
HEADER 1 COMPONENTS
AND RELIEF VALVES
CCWS
F411-09
DRAIN LINE FROM
LETDOWN HX AND
RELIEF VALVE
CCWS
F411-10
NOTE 5
TEST
DRAIN LINE FROM
ESSENTIAL REACTOR BUILDING
HEADER 1 COMPONENTS
AND RELIEF VALVES
CCWS
F411-02
NOTE 4
CCW SUMP PUMP
CCW SUMP 1
CC-1700
TO LWMS
LWMS
CC-1726
CC-1727
FI
CC-1731
CC-1730
TO SURGE TANK 1
CCWS
F411-01
FILENAME: F41117

NRC RAI 410.111



NOTES:

1. PRESSURE OVERFLOW PIPE TO EXTEND WITHIN 6 IN. FROM BOTTOM OF THE SUMP AND A MAXIMUM HEIGHT ABOVE THE SUMP OF 8 IN.
2. CLOSES ON CIAS
3. OPENS ON PREDETERMINED SURGE TANK LEVEL; CLOSES ON PREDETERMINED SURGE TANK LEVEL
4. PUMPS ARE ALTERNATED: START ON PREDETERMINED SUMP LEVEL; STOP ON PREDETERMINED SURGE TANK LEVEL OR SUMP LOW LEVEL; MANUAL OVERRIDE IS PROVIDED
5. EQUIPMENT DRAIN LINES WILL BE LOCATED AFTER EQUIPMENT HAS BEEN PURCHASED

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9201310151-07

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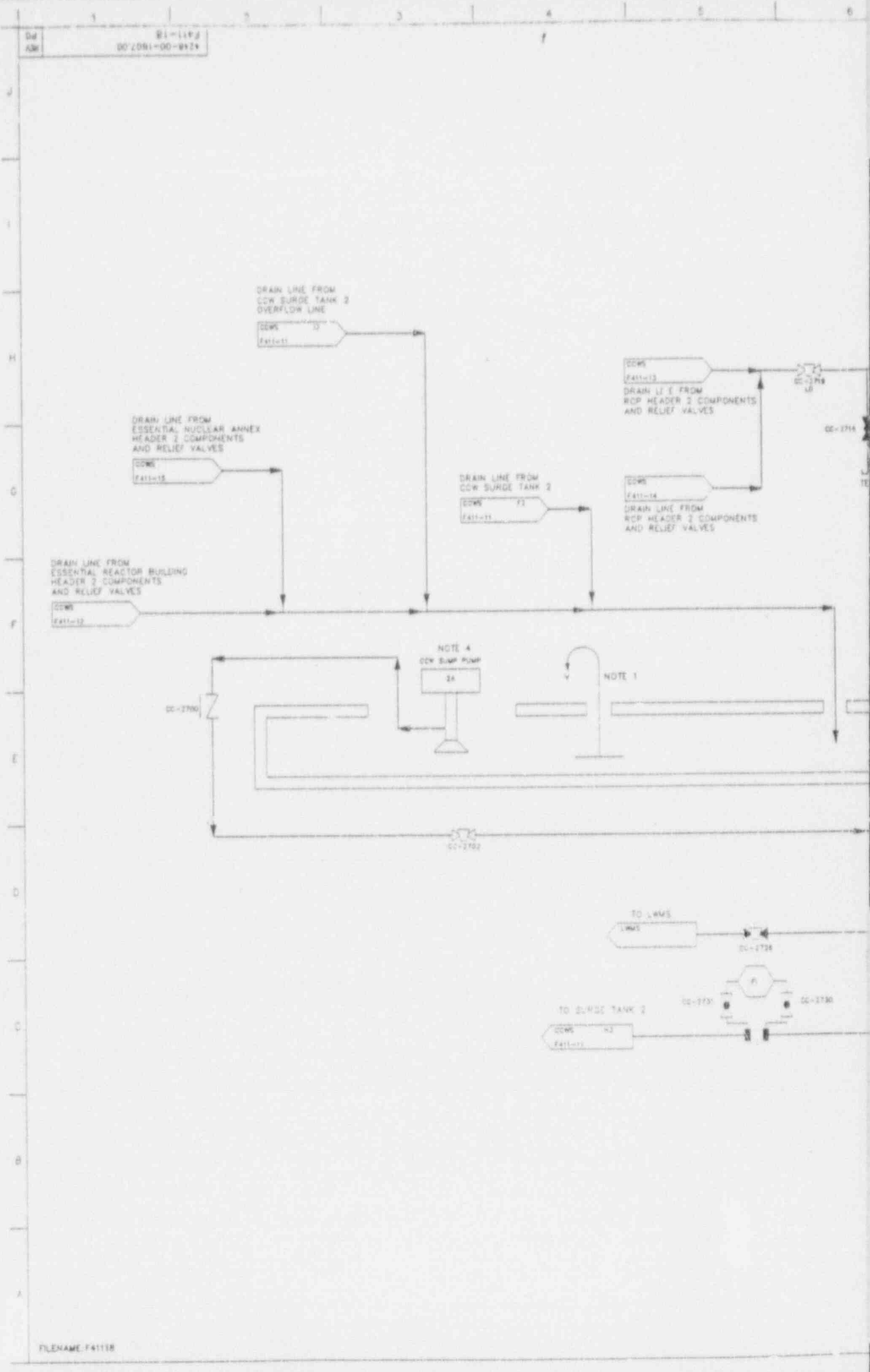
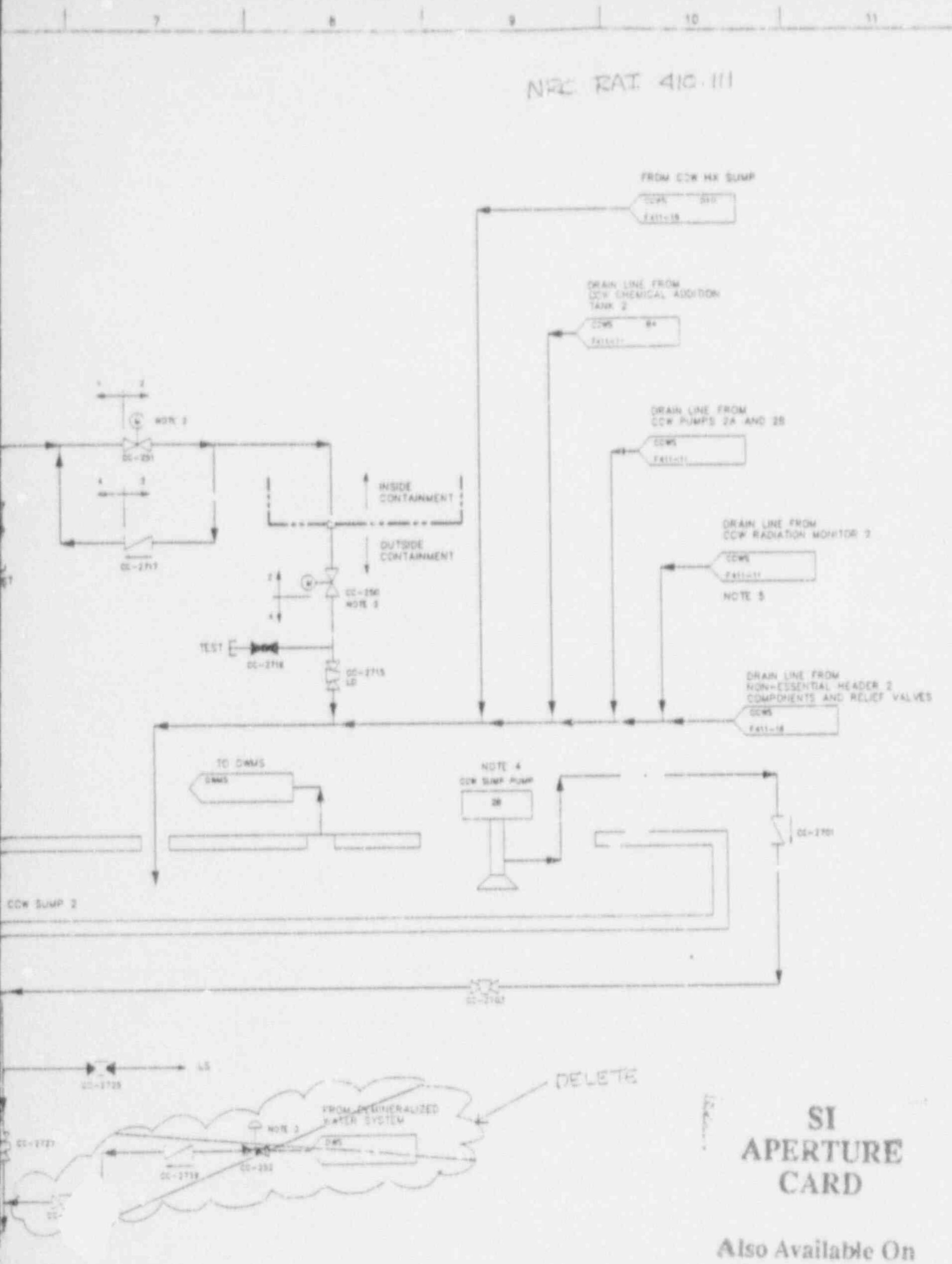
SYSTEM 80+™	COMPONENT COOLING WATER SYSTEM FLOW DIAGRAM	Figure 9.2.2-1



DRAIN LINE FROM
CCW SURGE TANK 2
OVERFLOW LINE
CCWS
DRAIN LINE FROM
ESSENTIAL NUCLEAR ANNEX
HEADER 2 COMPONENTS
AND RELIEF VALVES
CCWS
F411-15
DRAIN LINE FROM
CCW SURGE TANK 2
CCWS
DRAIN LINE FROM
RCP HEADER 2 COMPONENTS
AND RELIEF VALVES
CCWS
F411-14
DRAIN LINE FROM
RCP HEADER 2 COMPONENTS
AND RELIEF VALVES
DRAIN LINE FROM
ESSENTIAL REACTOR BUILDING
HEADER 2 COMPONENTS
AND RELIEF VALVES
CCWS
F411-12
NOTE 4
CCW SUMP PUMP
2A
NOTE 1
TO LWMS
LWMS
TO SURGE TANK 2
CCWS
FILENAME: F41118



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NOTES:

1. PRESSURE OVERFLOW PIPE TO EXTEND WITHIN 6 IN. FROM BOTTOM OF THE SUMP AND A MAXIMUM HEIGHT ABOVE THE SUMP OF 9 IN.
2. CLOSES ON CIAS.
3. OPENS ON PREDETERMINED SURGE TANK LEVEL; CLOSES ON PREDETERMINED SURGE TANK LEVEL.
4. PUMPS ARE ALTERNATED; START ON PREDETERMINED SUMP LEVEL; STOP ON PREDETERMINED SURGE TANK LEVEL OR SUMP LOW LEVEL. MANUAL OVERRIDE IS PROVIDED.
5. EQUIPMENT DRAIN LINES WILL BE LOCATED AFTER EQUIPMENT HAS BEEN PURCHASED.

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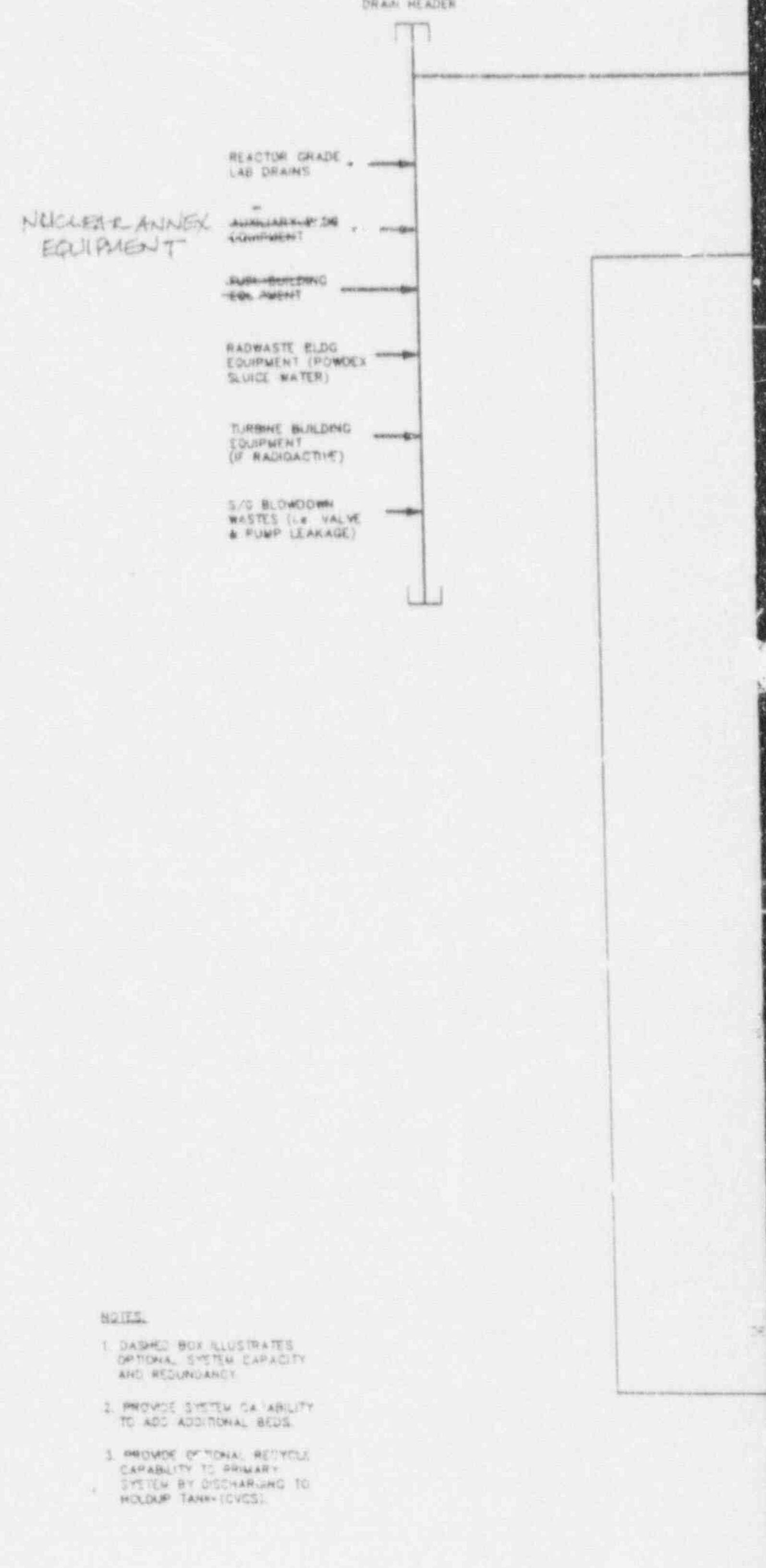
SYSTEM 80+™

COMPONENT COOLING WATER SYSTEM
FLOW DIAGRAM

Figure 9.2.2-1

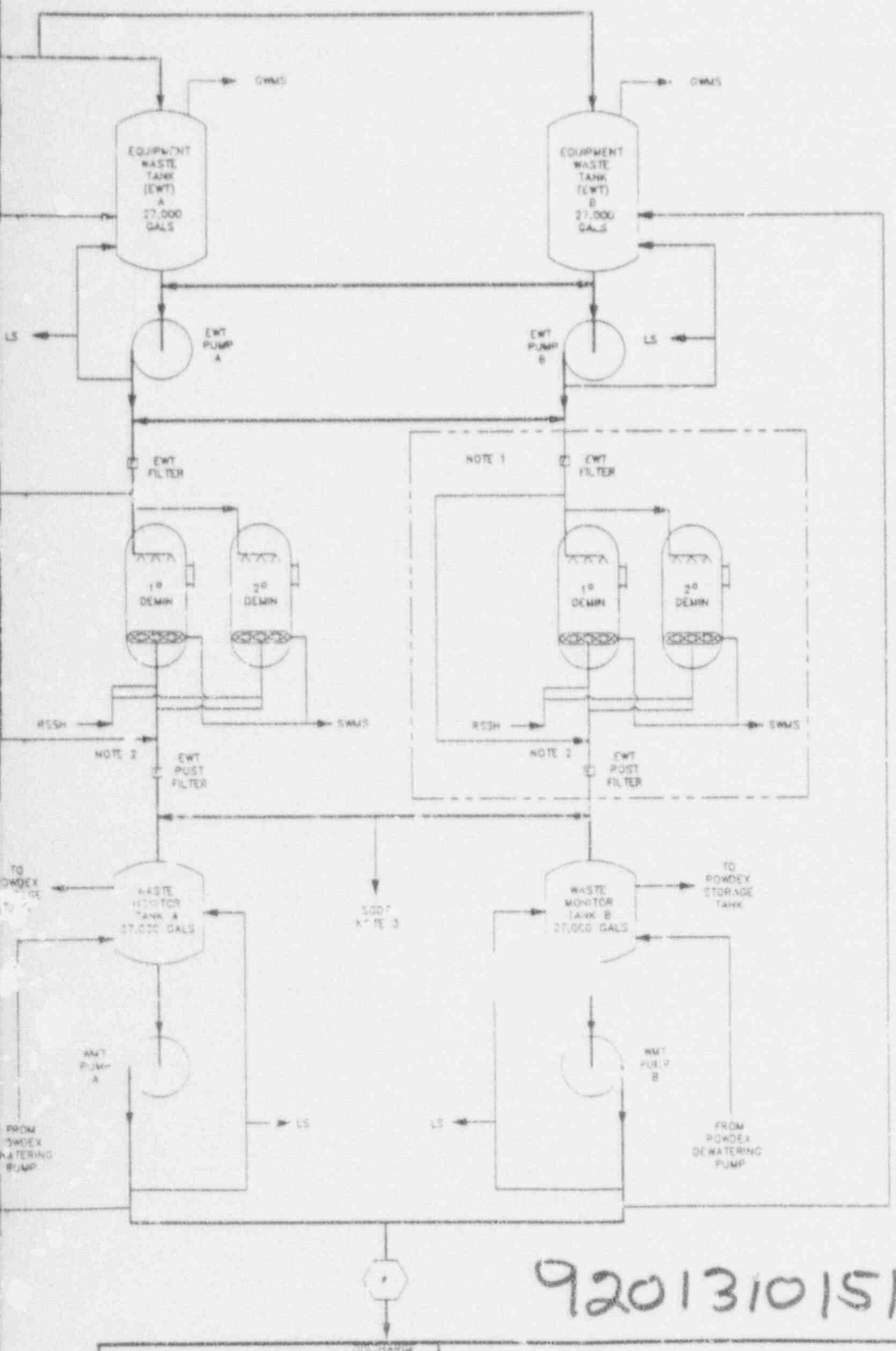


NOTES:

1. DASHED BOX ILLUSTRATES OPTIONAL SYSTEM CAPACITY AND REDUNDANCY.
2. PROVIDE SYSTEM CAPABILITY TO ADD ADDITIONAL BEDS.
3. PROVIDE OPTIONAL RECYCLE CAPABILITY TO PRIMARY SYSTEM BY DISCHARGING TO HOLDUP TANK (CVCS).

FILENAME F40701

NRC RAI 410.115



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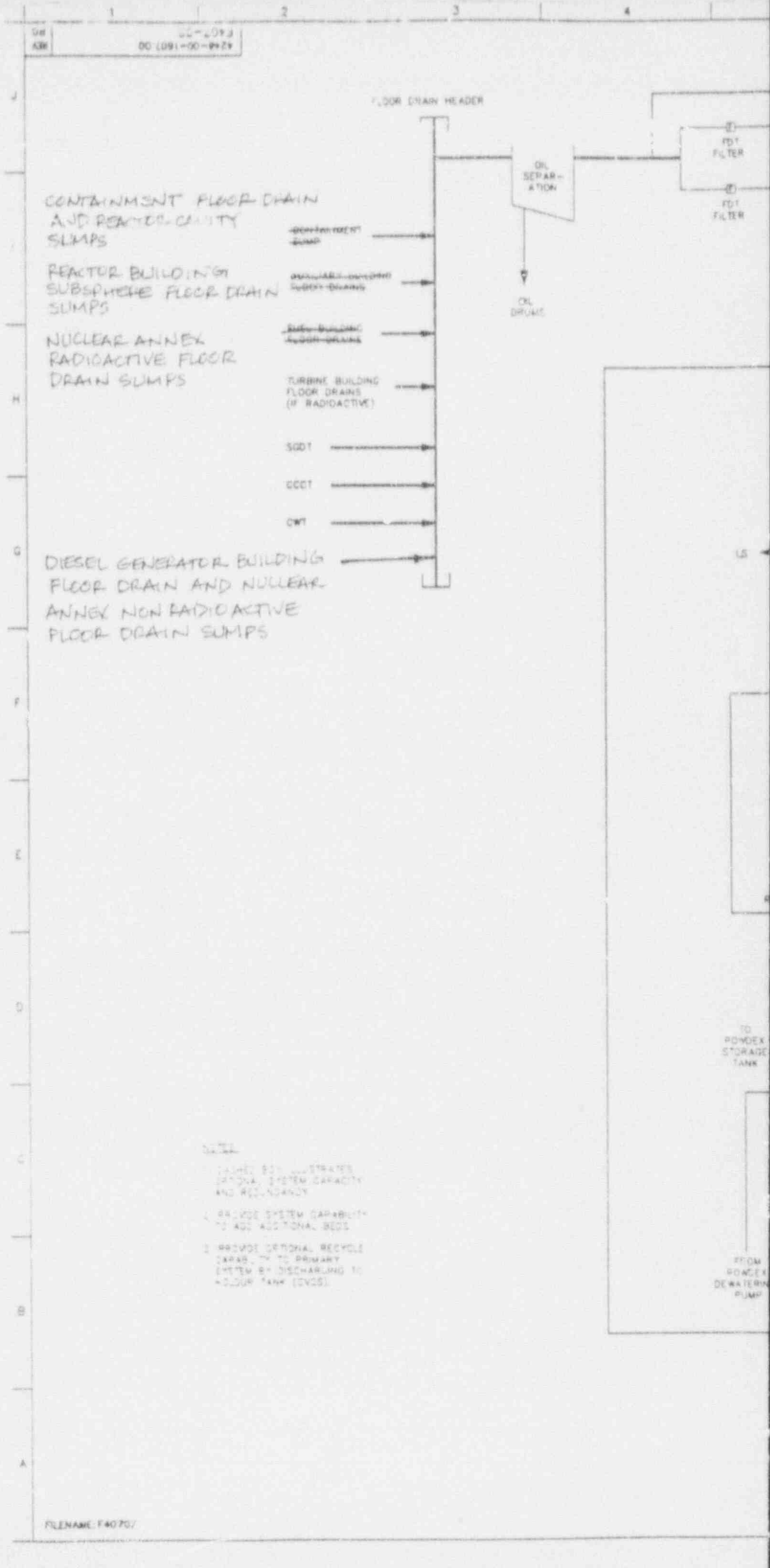
Amendment I
December 21, 1990

SYSTEM 80+ TM

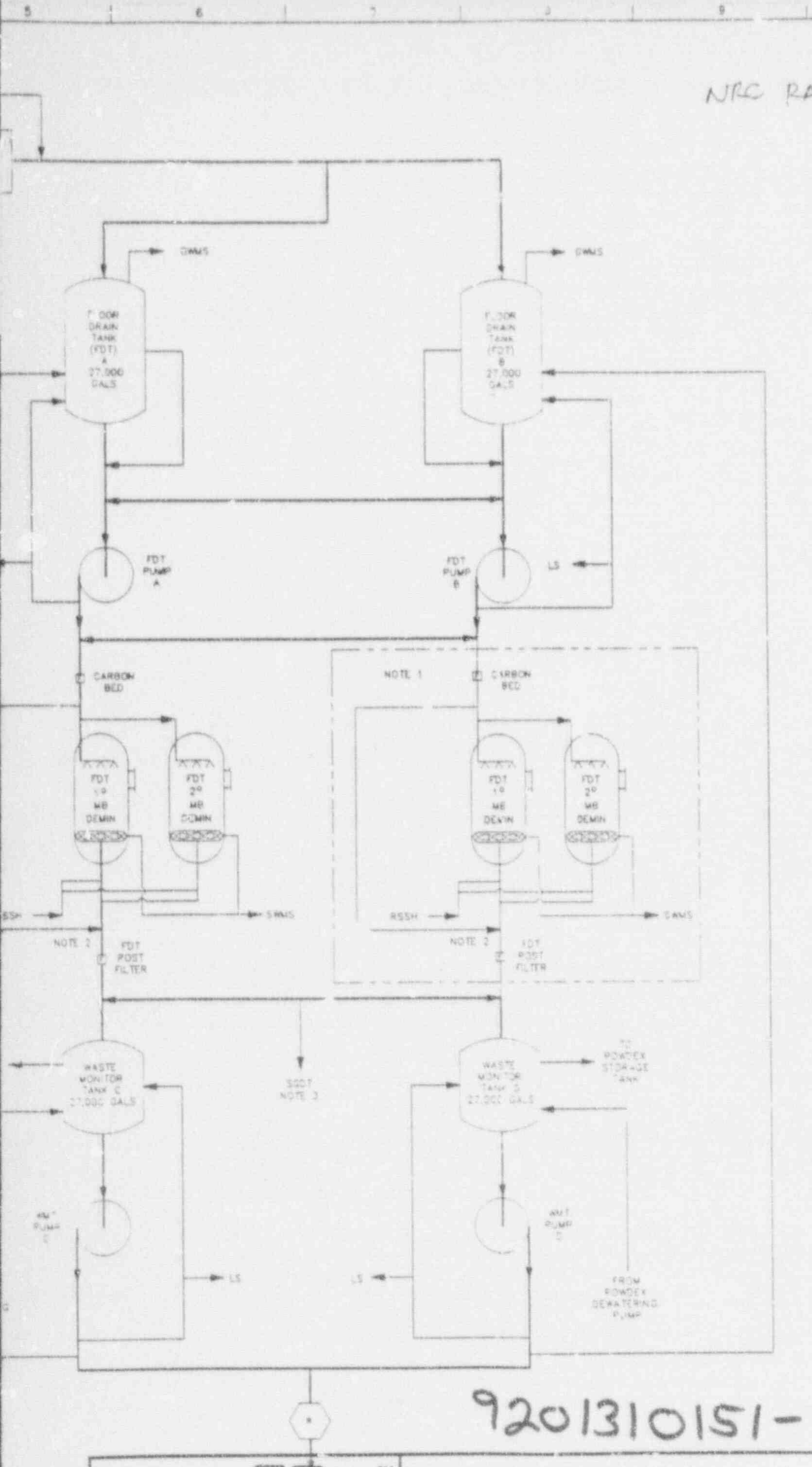
LIQUID WASTE MANAGEMENT SYSTEM (LWMS) FLOW DIAGRAM

Figure 11.2-1

Sheet 1 of 7


FLOOR DRAIN HEADER
OIL SEPAR-ATION
OIL DRUMS
FDT FILTER
FDT FILTER
CONTAINMENT FLOOR DRAIN AND REACTOR CAVITY SUMPS
CONTAINMENT SUMP
REACTOR BUILDING SUBSPHERE FLOOR DRAIN SUMPS
AUXILIARY BUILDING FLOOR DRAINS
NUCLEAR ANNEX RADIOACTIVE FLOOR DRAIN SUMPS
FUEL BUILDING FLOOR DRAINS
TURBINE BUILDING FLOOR DRAINS (IF RADIOACTIVE)
SGDT
CCDT
CWT
DIESEL GENERATOR BUILDING FLOOR DRAIN AND NUCLEAR ANNEX NON RADIOACTIVE FLOOR DRAIN SUMPS
LS
TO POWDEX STORAGE TANK
FROM POWDEX DEWATERING PUMP
FILENAME: F40707

NRC RAI 410.115



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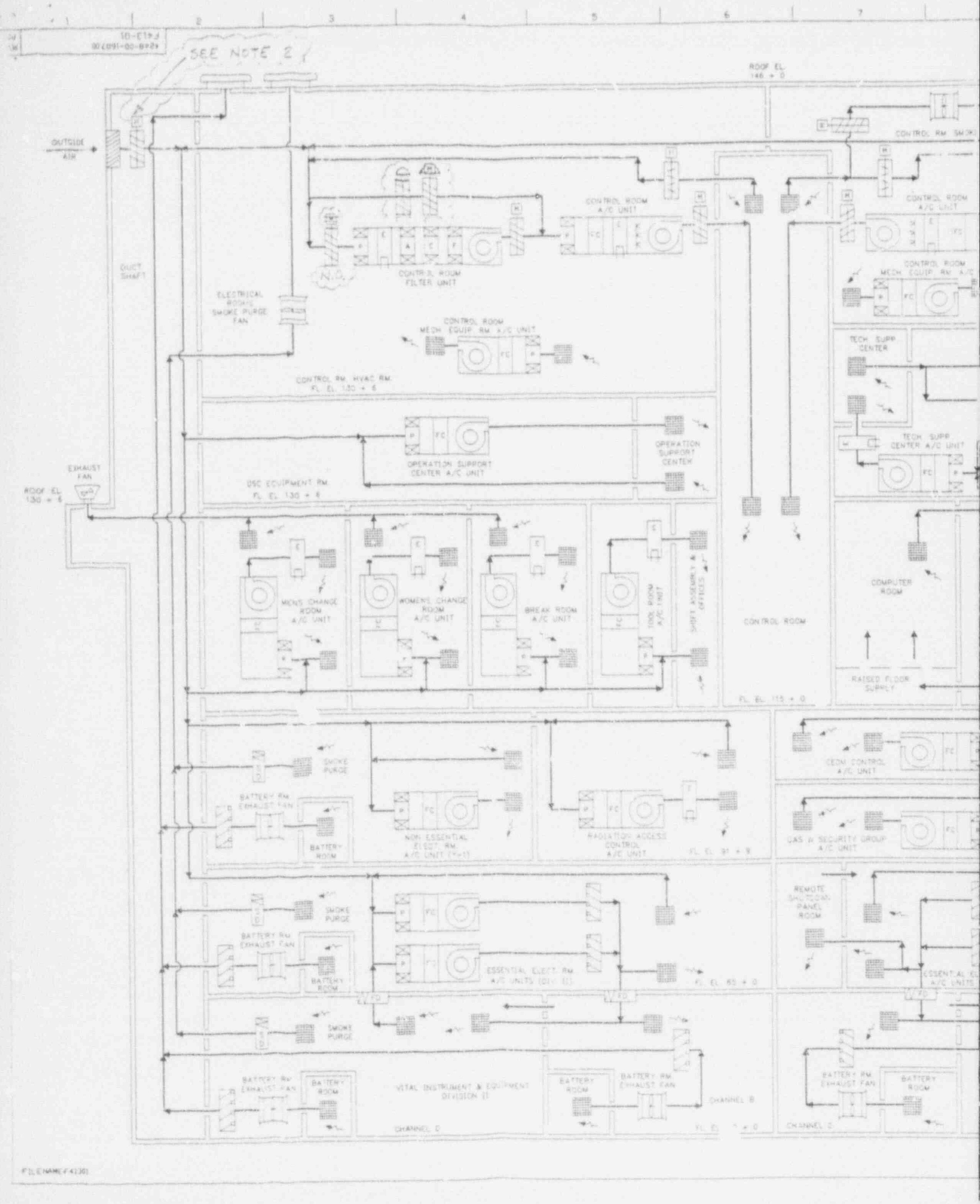
December 21, 1990

SYSTEM 80+™

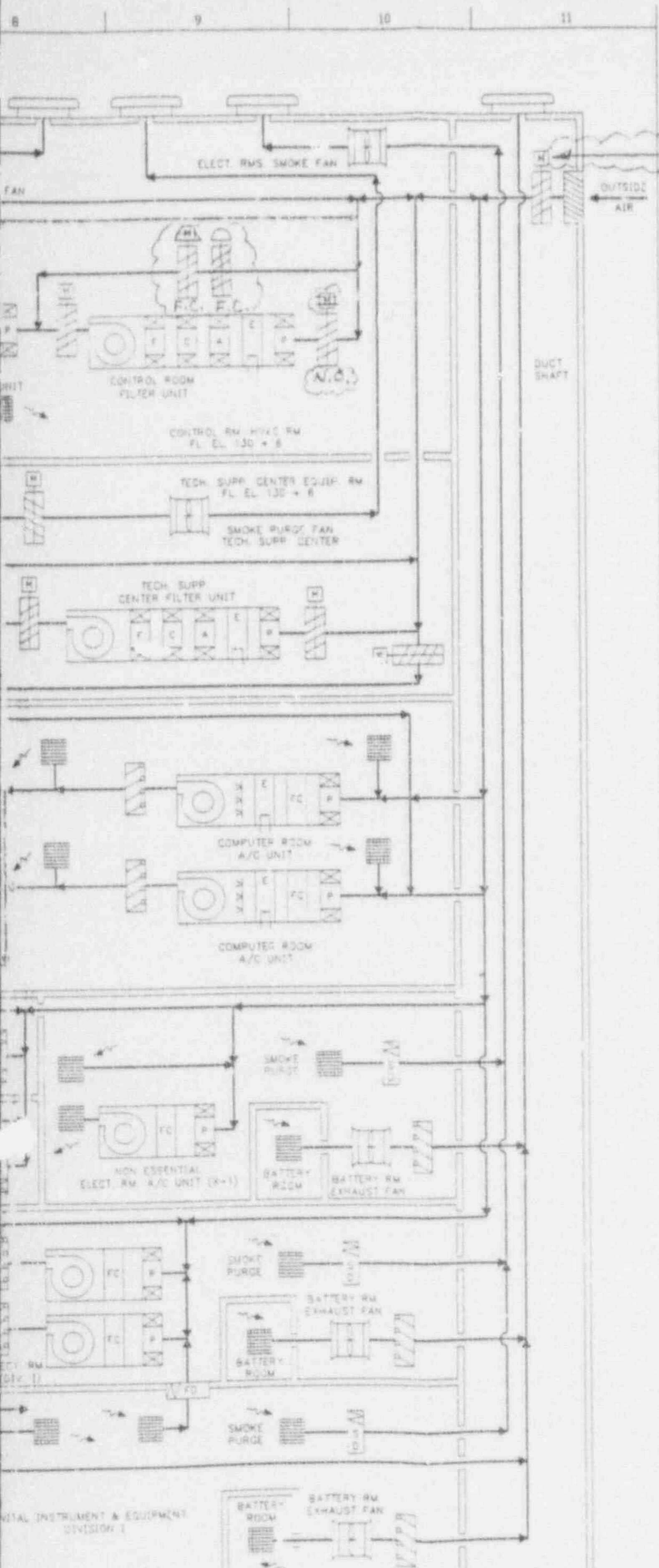
LIQUID WASTE MANAGEMENT SYSTEM (LWMS)
FLOW DIAGRAM

Figure
11.2-1

Sheet 2 of 7


SEE NOTE 2
ROOF EL. 146 + 0
OUTSIDE AIR
DUCT SHAFT
ELECTRICAL ROOMS SMOKE PURGE FAN
N.O.
CONTROL ROOM FILTER UNIT
CONTROL ROOM A/C UNIT
CONTROL RM. SMOKE
CONTROL ROOM MECH. EQUIP. RM. A/C UNIT
CONTROL RM. HVAC RM. FL. EL. 130 + 6
TECH SUPP CENTER
TECH SUPP CENTER A/C UNIT
OPERATION SUPPORT CENTER A/C UNIT
OPERATION SUPPORT CENTER
OSC EQUIPMENT RM. FL. EL. 130 + 6
EXHAUST FAN
ROOF EL. 130 + 6
MENS CHANGE ROOM A/C UNIT
WOMENS CHANGE ROOM A/C UNIT
BREAK ROOM A/C UNIT
TOOL ROOM A/C UNIT
SHIFT ASSEMBLY & OFFICES
CONTROL ROOM
COMPUTER ROOM
RAISED FLOOR SUPPLY
FL. EL. 115 + 0
SMOKE PURGE
BATTERY RM. EXHAUST FAN
BATTERY ROOM
NON ESSENTIAL ELECT. RM. A/C UNIT
RADIATION ACCESS CONTROL A/C UNIT
FL. EL. 91 + 9
CEOM CONTROL A/C UNIT
GAS W SECURITY GROUP A/C UNIT
REMOTE SHUTDOWN PANEL ROOM
ESSENTIAL ELECT. RM. A/C UNITS (DIV. II)
FL. EL. 85 + 0
VITAL INSTRUMENT & EQUIPMENT DIVISION II
CHANNEL D
CHANNEL B
CHANNEL C
FILENAME F41301

Q410.116



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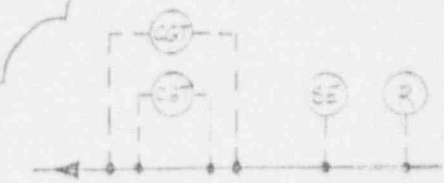


The radiation, smoke and toxic gas detectors will be shown at each outside air intake on the next amendment to the CESSAR-DC.

NOTE:

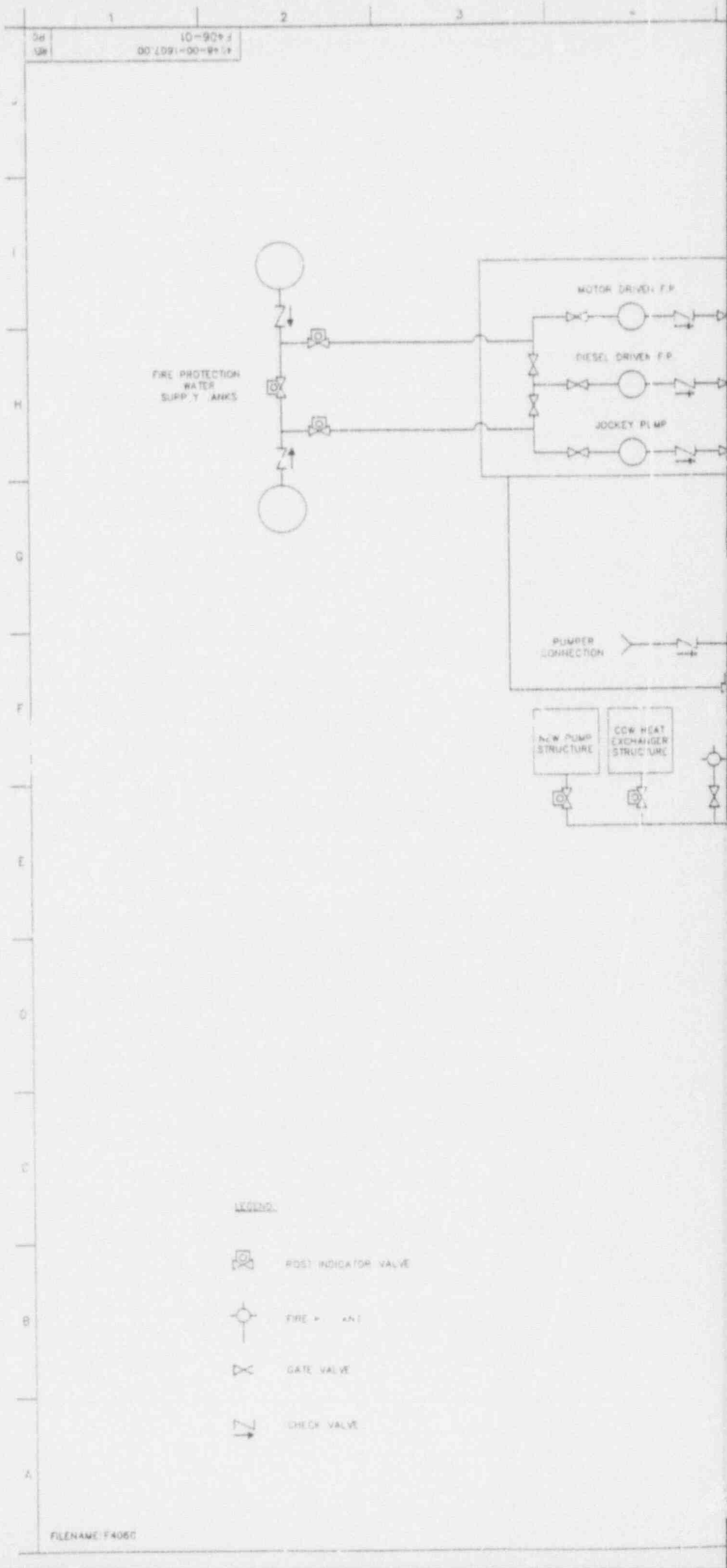
1. Changes [illegible]
2. Each [illegible]

9201310151-11

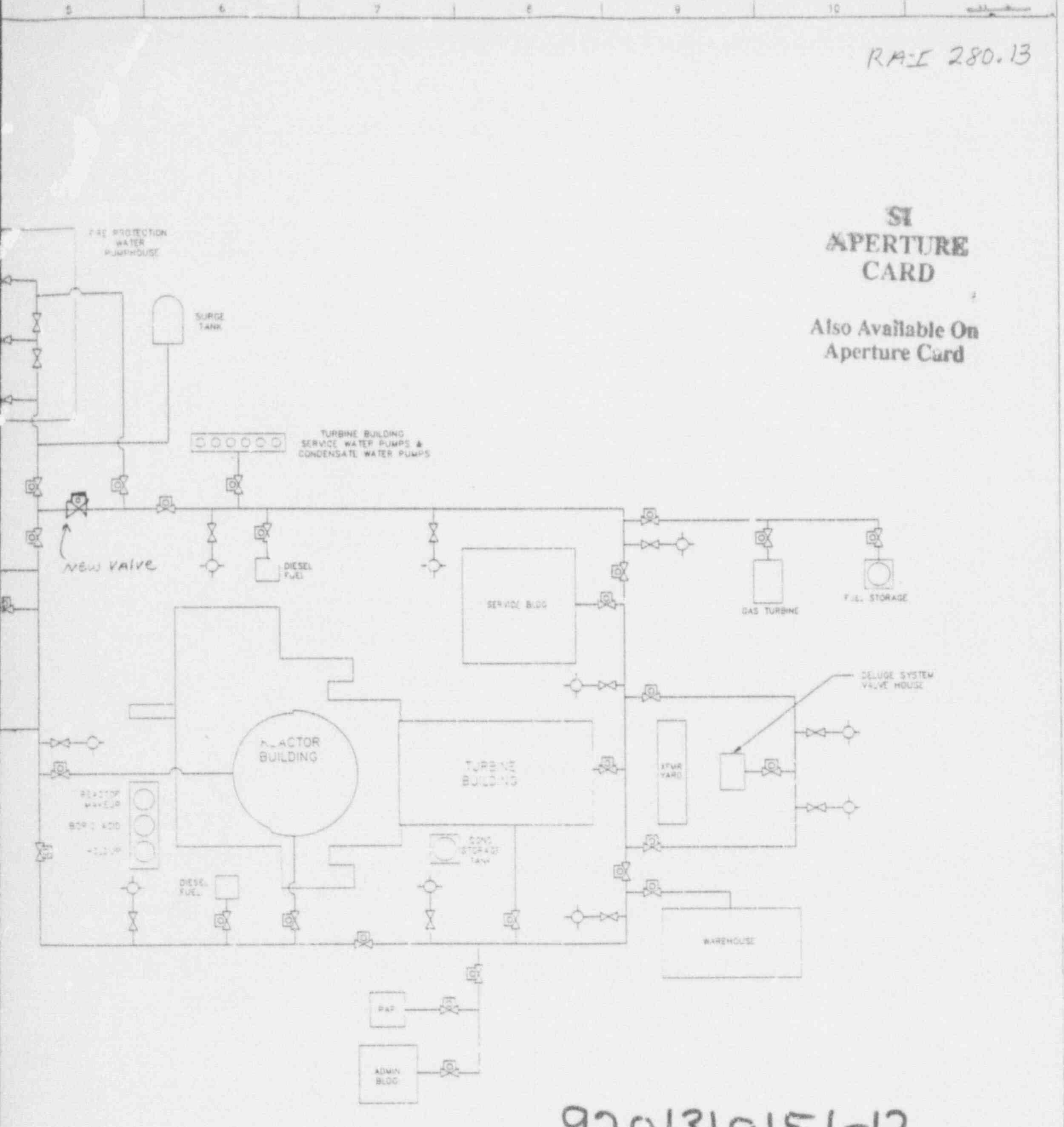
Amend
Decem

SYSTEM 80+™

NUCLEAR ANNEX CONTROL BUILDING
AIR FLOW DIAGRAM
FIGURE 9.4-2


F406-01
4148-00-1607.00
FIRE PROTECTION
WATER
SUPP Y ANKS
MOTOR DRIVEN F.P.
DIESEL DRIVEN F.P.
JOCKEY PUMP
PUMPER
CONNECTION
NEW PUMP
STRUCTURE
CCW HEAT
EXCHANGER
STRUCTURE
LEGEND:
POST INDICATOR VALVE
FIRE
GATE VALVE
CHECK VALVE
FILENAME: F406C

RAI 280.13



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Amendment I
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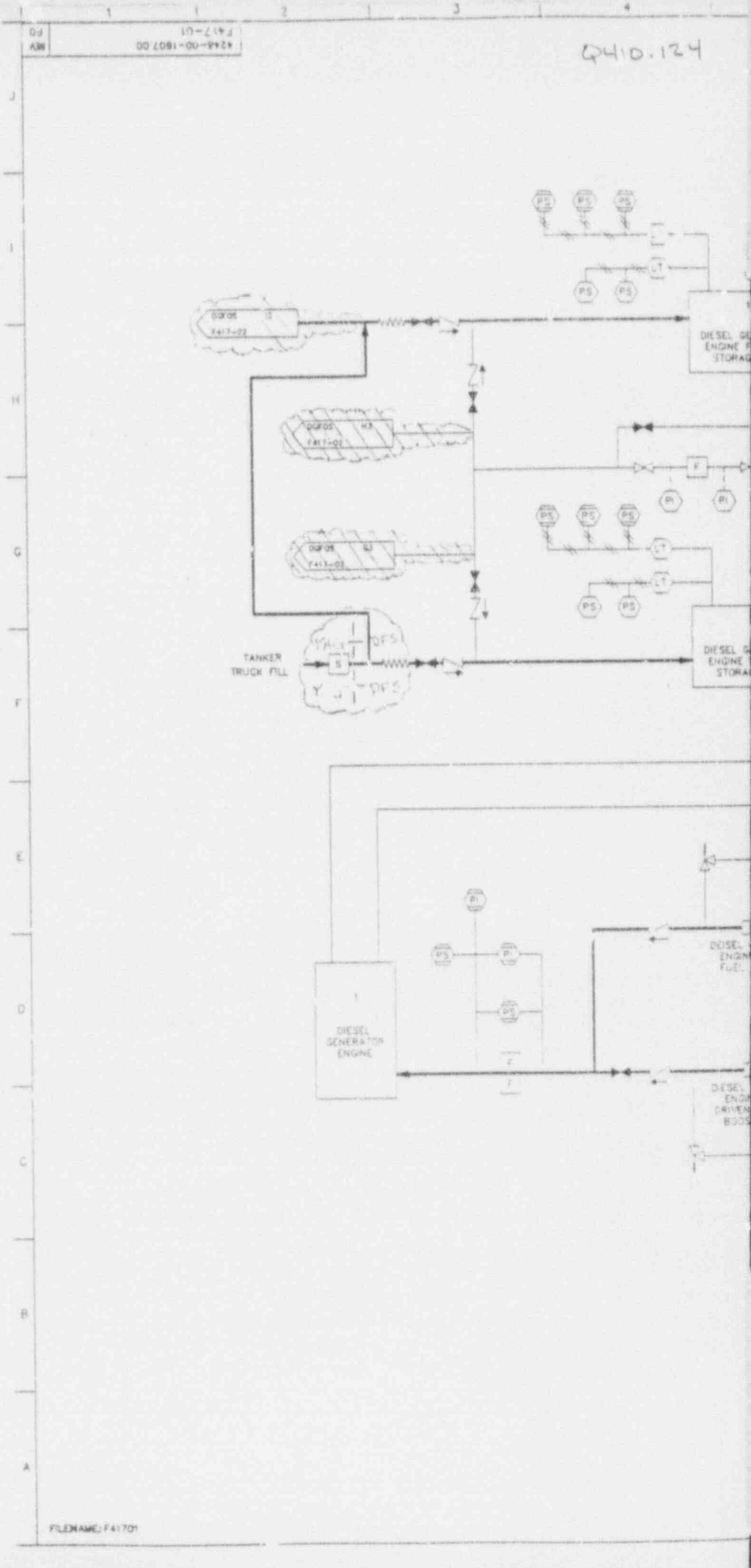
SYSTEM 80+™	FIRE PROTECTION WATER DISTRIBUTION SYSTEM FLOW DIAGRAM	Figure 9.5.1-1


Q410.124
4248-00-1807.00
F417-01
REV
DGF05
F417-02
PS
LT
PI
TANKER
TRUCK FILL
DFS
DIESEL GENERATOR ENGINE
1
FILENAME: F41701

DELETE CROSS-HATCHED AREAS

ADD ITEMS IN CLOUDS

SI
APERTURE
CARD

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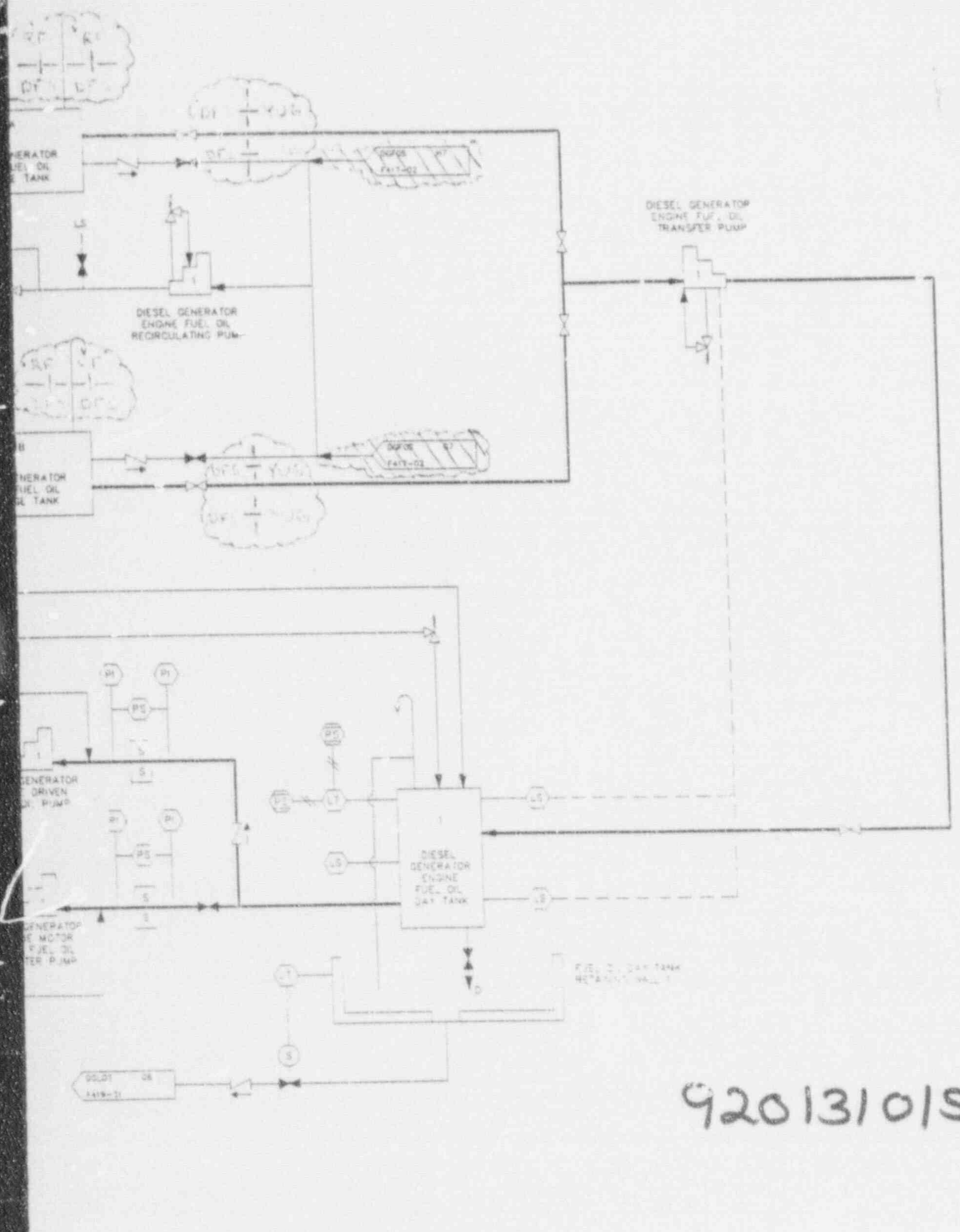

9201310151-13

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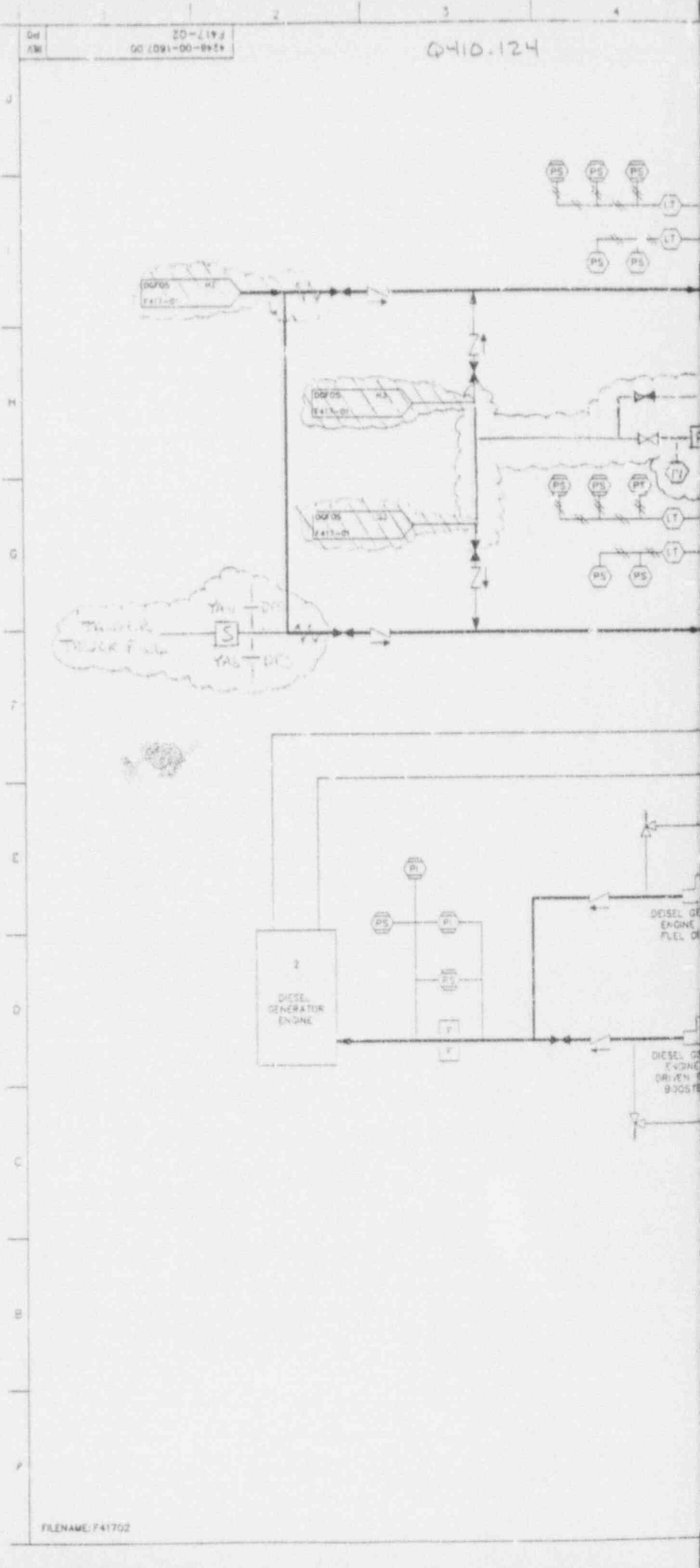
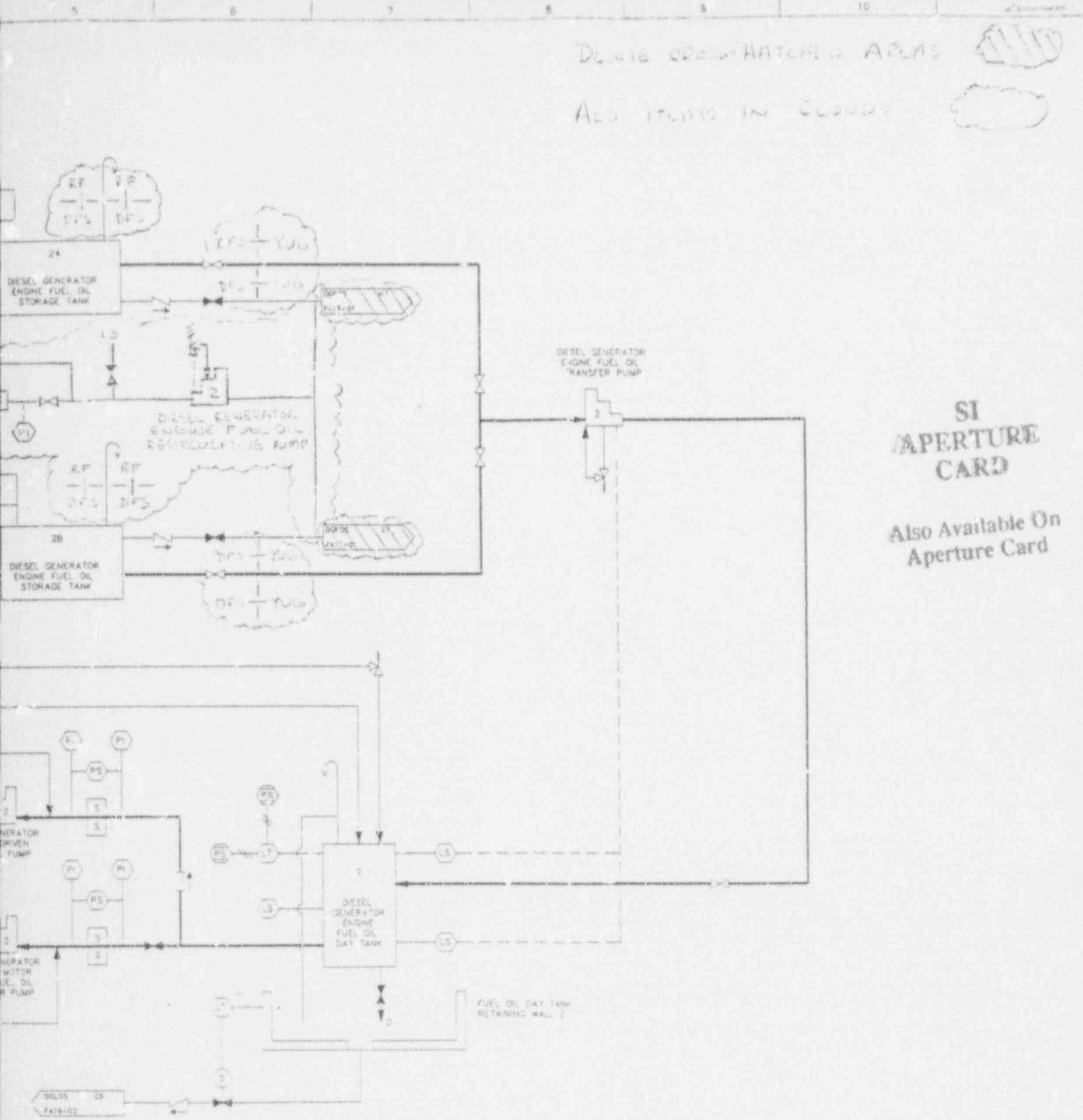
SYSTEM 80+™	DIESEL GENERATOR ENGINE FUEL OIL SYSTEM FLOW DIAGRAM	Figure 9.5.4-1

Sheet 1 of 2


Q410.124
DGF05
F417-01
PS
LT
PT
PI
S
TANKER TRUCK FILL
2
DIESEL GENERATOR ENGINE
FILENAME: F41702



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9201310151-14

Amendment I
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SYSTEM 80+™	DIESEL GENERATOR ENGINE FUEL OIL SYSTEM FLOW DIAGRAM	Figure 9.5.4-1

Sheet 2 of 2

OVERSIZE DOCUMENT PAGE PULLED

SEE APERTURE CARDS

NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 23 (2 dupes)

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355
360
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390
394
397
401
443
457
461
469

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484
490

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