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SUBJECT: Provides util response to Generic Ltr 89-13 re svc water sys.

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AEP:NRC:1104
GL 89-13

Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
GENERIC LETTER 89-13 SERVICE WATER SYSTEM
PROBLEMS RESPONSE

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

Attn: A. B. Davis

January 25, 1990

Dear Mr. Davis:

This submittal responds to your Generic Letter (GL) 89-13 received August 1, 1989. As defined by GL 89-13, the service water system for Donald C. Cook Nuclear Plant Units 1 and 2 includes both the essential service water (ESW) and the component cooling water (CCW) systems. However, the latter system satisfies the conditions stipulated for a closed-cycle system and therefore will not be addressed herein with regard to the specific actions required by GL 89-13. In addition to the open-cycle service water system, because of its importance and the fact that it uses raw water as a source, the fire protection system will also be addressed in the cases where recommended actions are applicable.

Attachment 1 contains our responses to each action item I through V, including the recommendations made in the enclosures, contained in GL 89-13. The ESW and fire protection systems at Cook Nuclear Plant are described in Chapter 9 of the Updated Final Safety Analysis Report. Attachment 2 contains applicable portions of the UFSAR for convenience.

We intend to submit a confirmation of actions and recommendations implemented for both units within 30 days of completion of the Unit 1 refueling cycle which is tentatively scheduled for December 21, 1990.

A065
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This letter is submitted pursuant to 10 CFR 50.54(f) and, as such, an oath of affirmation is enclosed.

Sincerely,

M. P. Alexich
Vice President

ldp

cc: D. H. Williams, Jr.
A. A. Blind - Bridgman
R. C. Callen
G. Charnoff
T. E. Murley
NRC Resident Inspector - Bridgman
NFEM Section Chief

STATE OF OHIO)
COUNTY OF FRANKLIN)

Milton P. Alexich, being duly sworn, deposes and says that he is the Vice President of licensee Indiana Micigan Power Company, that he has read the forgoing Response to Generic Letter 89-13: Service Water System Problems Response and knows the contents thereof; and that said contents are true to the best of his knowledge and belief.

M. P. Alexich

Subscribed and sworn to before me this 25th

day of January, 1990.

Rita D. Hill
NOTARY PUBLIC

RITA D. HILL
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES 6-28-94

ATTACHMENT 1 TO AEP:NRC:1104

RESPONSE TO GENERIC LETTER 89-13
ACTION ITEMS, INCLUDING THE RECOMMENDATIONS
CONTAINED IN THE ENCLOSURES

ATTACHMENT 1 TO AEP:NRC:1104

Responses to Actions I through V of Generic Letter 89-13 are as follows:

ACTION I

"For open-cycle service water systems, implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. A program acceptable to the NRC is described in "Recommended Program to Resolve Generic Issue 51" (Enclosure 1). It should be noted that Enclosure 1 is provided as guidance for an acceptable program. An equally effective program to preclude biofouling would also be acceptable. Initial activities should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. All activities should be documented and all relevant documentation should be retained in appropriate plant records."

RESPONSE I

As a result of NRC IE Bulletin 81-03 entitled "Flow Blockage of Cooling Water to Safety System Components by Corbicula sp. (Asiatic clam) and Mytilus sp. (Mussel)" and INPO SOER 84-01 entitled "Cooling Water System Degradation Due to Aquatic Life," a program essentially in compliance with Enclosure 1 of Generic Letter 89-13 has already been established at Cook Nuclear Plant. With regard to the four specific recommendations of Enclosure 1, the following is a description of the program activities already in place and program enhancements that will be implemented prior to startup following the next refueling outage.

Recommendation A of Enclosure 1

Cook Nuclear Plant already complies with and will continue to comply with this recommendation. At least once per refueling cycle, the intake forebays are visually inspected for the presence of macroscopic biological fouling organisms, sediment, corrosion products, and miscellaneous debris. Inspections are performed by divers, with underwater cameras being used to document findings. Unusual sand accumulations and any debris that may have collected are removed at the time of the inspection. Evidence of macroscopic biological fouling has not been found.

Recommendation B of Enclosure 1

Temporary chlorination facilities can be connected to the open-cycle service water system at Cook Nuclear Plant. However, the water is presently not chlorinated because an actual macroscopic biological fouling problem has not been demonstrated to exist. Likewise, there has been no indication of microbiological growth during periods of high lake temperatures that would warrant chlorination of the service water system.

However, since chlorination (liquid) of the circulating water has been necessary to prevent microbiological growth (slime buildup) in the tubes of the main and feedpump turbine condensers, a similar chlorination (liquid) program will be prepared on a contingency basis for the open-cycle service water system. Pending approval of the appropriate Federal, State, and local agencies, this program will consist of approximately 30 minutes per day chlorination from April through October. This program will comply with all environmental regulations regarding the use of biocides.

If necessary, fire protection water could be subjected to a chlorination program, because all normally used fire pumps take suction either directly or indirectly from the circulating water system. However, since macrobiological fouling is not a demonstrated concern at the plant and microbiological growth would not seriously impact flow capability, chlorination of the fire protection water is not considered necessary at this time.

Recommendation C of Enclosure 1

Practices already in-place at Cook Nuclear Plant will be augmented and formalized to provide compliance with this recommendation.

A discussion of those portions of the open-cycle service water system which could be considered as "redundant and infrequently used cooling loops" is as follows:

- Containment spray (CTS) heat exchangers and associated ESW piping - During normal operation, the ESW discharge valves on the CTS heat exchangers are closed. This results in the shell side of the CTS heat exchangers and the ESW supply piping from the main ESW headers being filled with ESW.

  During an ESW flow test in 1986, it was discovered that the CTS heat exchanger shell side pressure drop, at the design flow, had increased from the original pressure drop recorded during the system preoperational test. The shell sides of the CTS heat exchangers were inspected and chemically cleaned; subsequent testing showed that the pressure drops were reduced to near the preoperational test values. Sediment and corrosion were determined to be the cause of the increased pressure drop. Biological fouling was not a factor.

  Presently, the shell side of the CTS heat exchangers and the associated piping are flushed during the ESW flow balance procedure performed at each refueling outage. The ESW flow balance procedure will be augmented to record and trend the CTS heat exchanger pressure drops.

- Piping from each standby ESW pump discharge to the common ESW headers - The ESW system is typically operated with a particular pump in service on each train. Running of the

standby pump is limited to monthly (Unit 1) and quarterly (Unit 2) surveillance testing, which results in the discharge piping associated with each train's standby pump remaining stagnant most of the time. However, the surveillance test, which requires the standby pump to run at about 7,000 gpm, is considered sufficient to meet the requirements for periodic flushing.

- ESW piping to the control room air handler unit cooling coils - During normal operation, a non-safety related closed-cycle chiller package provides cooling for the control room HVAC system. The safety-related backup to this arrangement is a connection to the ESW system which allows lake water to flow through the cooling coils of the air handling units.

  The ESW supply lines to the cooling coils are short vertical lines that occasionally accumulate sand. Since sand accumulation could interfere with flow through the coils in the event ESW was needed to provide control room cooling, a program has already been established to periodically open, inspect, and clean the supply lines. Originally, the inspection interval was set at 6 months, but has since been changed to 12 months due to the very minor accumulations of sand that have actually been found. Biological fouling of any type has not been noted.

  Direct flushing of the supply lines is not practical since discharge of ESW to the closed-cycle chiller package under normal circumstances is undesirable. Installation of backflushing connections is being considered, but will only be implemented if considered cost effective in comparison to the current inspection program.

- ESW supply piping to the auxiliary feedwater (AFW) system alternate suction source - Although not a "cooling loop" in the same sense as the other areas discussed above, the ESW supply to the AFW pumps as a backup to the condensate storage tank would provide an important cooling function if needed.

  A partial flushing of these lines was performed in 1989 as part of an investigation related to an incident at Byron Nuclear Plant where sediment was found in their ESW-to-AFW supply lines. Little or no sediment and no evidence of biological fouling was found in the lines at Cook Nuclear Plant. Surveillance procedures related to AFW system operability will be augmented to verify, once per cold shutdown but not more frequently than every 92 days, that the flow path from ESW to the AFW alternate suction source is open.

The actions discussed above will ensure that "redundant and infrequently used cooling loops in the open-cycle service water system at Cook Nuclear Plant will not be fouled or clogged if called on to function.

The testing and/or inspections of other components as described in our response to Action II of Generic Letter 89-13 will ensure that those components are not fouled or clogged.

The open-cycle service water system is rarely, if ever, placed in layup. This system is always in operation to provide the required cooling during all phases of unit operation or shutdown. If maintenance is required on a train or train component, the involved portion is isolated and drained for the repair.

The fire protection system components are inspected or tested as scheduled on a 12- or 18-month cycle. The yard piping portion of the system is flushed every six months and the pressure is monitored at the hydrants to ensure an unrestricted flow path. Additionally, applicable portions of the system are flow tested on a three-year cycle in accordance with Chapter 5, Section 11 of the Fire Protection Handbook, 14th Ed., published by the National Fire Protection Association.

Recommendation D of Enclosure 1

Cook Nuclear Plant already complies with and will continue to comply with this recommendation. Divers collect sediment samples from the forebay and from the substrate located near the intake structure, and water samples are taken from the plant discharge flow during the spawning season. The substrate and water samples are analyzed by biologists for the presence of Asiatic clam adults and larvae, respectively. In the future, samples will also be examined for the presence of Zebra mussels.

In addition to the annual sampling program, Cook Nuclear Plant has implemented a beach walk program, in which trained biologists routinely inspect the beaches in the vicinity of the plant to look for shells or other evidence of Asiatic clam colonization in the lake. Future beach walks will also consider potential colonization by Zebra mussels.

ACTION II

"Conduct a test program to verify the heat transfer capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial test program and a periodic retest program."

RESPONSE II

A formal program will be defined and implemented at Cook Nuclear Plant to monitor all safety-related heat exchangers served by the open-cycle service water system. The affected components are:

- CCW heat exchangers (two per unit; four total)
- CTS heat exchangers (two per unit; four total)

- Emergency diesel generator (EDG) jacket water coolers (one per diesel; four total)
- EDG lube oil coolers (one per diesel; four total)
- EDG air after coolers (two per diesel; eight total)
- Control room air handler units (two per unit; four total)
- Diesel driven fire pump lube oil coolers (one per diesel; two total)

With regard to the four specific recommendations of Enclosure 2, program activities already in place or which will be implemented prior to startup following the next refueling outage on each unit are as follows:

Recommendation I of Enclosure 2

The Cook Nuclear Plant's heat exchanger program will periodically monitor and record the cooling water flow, inlet and outlet temperatures, and pressures for the safety-related heat exchangers. This information will be verified to be within design limits and will be used to evaluate and trend component performance. The control room air handler units will be exempted from this program since they are not normally supplied by the service water system. During normal operation, these components are cooled by a closed-cycle chiller package and are therefore not subject to biofouling or corrosion. Heat transfer degradation of this equipment, although very unlikely to occur, would be observable during seasonal operation of the system.

Recommendation II of Enclosure 2

Functional testing of safety-related water-to-water and water-to-oil heat exchangers will be performed as illustrated in Figures 1 through 4.

Recommendation III of Enclosure 2

Functional testing of safety-related air-to-water heat exchangers will be performed as illustrated in Figure 5.

Recommendation IV of Enclosure 2

In general, this recommendation is not applicable to the small heat exchangers (penetration coolers, oil coolers, and motor coolers) used at Cook Nuclear Plant since these items are served by the CCW system, not the open-cycle service water system.

The only exceptions are the diesel driven fire pump lube oil coolers. Every 18 months, these coolers are inspected and the sacrificial anodes provided for corrosion protection are replaced. These components, which are cooled by the pump's discharge water (service water), are tested during the diesel driven fire pump's monthly surveillance test. Heat

transfer degradation of this equipment would be indicated during the surveillance test by an abnormally low cooling water temperature rise across the cooler. Future surveillance tests will monitor and trend the temperature rise. This information, coupled with the 18-month inspection results, will ensure that a fouling condition does not go undetected.

ACTION III

"Ensure by establishing a routine inspection and maintenance program for open-cycle service water system piping and components that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water. The maintenance program should have at least the following purposes:

- To remove excessive accumulations of biofouling agents, corrosion products, and silt;
- To repair defective protective coatings and corroded service water system piping and components that could adversely affect performance of their intended safety functions."

RESPONSE III

At present, the Cook Nuclear Plant inspection and maintenance program for open-cycle service water system piping and components is performed on a post-maintenance basis. However, some particular components, such as the EDG jacket water coolers, are opened, inspected, and cleaned on a scheduled basis. Certain portions of the piping, as noted previously in our response to Action I, are also routinely opened, inspected, and cleaned. The remainder of the service water system components are checked for biofouling, silting, and corrosion product buildup whenever they are opened for required maintenance. If any foreign material is found, appropriate personnel are notified and the material is removed.

Based on a review of maintenance records for the past two years, it appears that the existing practices have been effective in preventing the sort of major common-mode failure of safety-related service water systems addressed by Generic Letter 89-13. However, results of the testing and trending program established in response to Action II will be reviewed to determine if development of a more comprehensive inspection and maintenance program is warranted.

Additionally, an erosion monitoring program consisting of cycle-to-cycle UT wall thickness measurement of selected service water system piping elbows will be implemented. Selection of locations to monitor will be based on a design review to determine the most likely spots for erosion to occur. Revision or expansion of the program will depend on evaluation and trending of the accumulated data.

ACTION IV

"Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant. Reconstitution of the design basis of the system is not intended. This confirmation should include a review of the ability to perform required safety functions in the event of failure of a single active component. To ensure that the as-built system is in accordance with the appropriate licensing basis documentation, this confirmation should include recent (within the past two years) system walkdown inspections. This confirmation should be completed before plant startup following the first refueling outage beginning nine months or more after the date of this letter. Results should be documented and retained in appropriate plant records."

RESPONSE IV

A review of Cook Nuclear Plant's service water system has confirmed that the system is capable of performing its required safety function in the event of failure of a single active component. The service water system is designed to prevent any failure, active or passive, from limiting its ability for long term heat removal.

A complete system walkdown was performed in 1984 by operations and engineering personnel. This walkdown compared the as-built system with the operational flow diagram. All discrepancies were noted and corrected on the flow diagrams at that time. The discrepancies found were all minor in nature and did not impact the ability of the service water system to perform its intended functions. Even though the complete walkdown did not occur during the last two years as recommended, we believe it meets the intent and the requirements of the generic letter. The Cook Nuclear Plant design change procedures ensure that any modifications to the system since the 1984 walkdown would have been subject to walkdowns of the affected portion of the system pre- and post-change, and would ensure that the design function of the system was not adversely impacted by the change.

ACTION V

"Confirm that maintenance practices, operating and emergency procedures, and training that involves the service water system are adequate to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. This confirmation should include recent (within the past two years) reviews of practices, procedures, and training modules. The intent of this action is to reduce human errors in the operation, repair, and maintenance of the service water system. This confirmation should be completed before plant startup following the first refueling outage beginning nine months or more after the date of this letter. Results should be documented and retained in appropriate plant records."

RESPONSE V

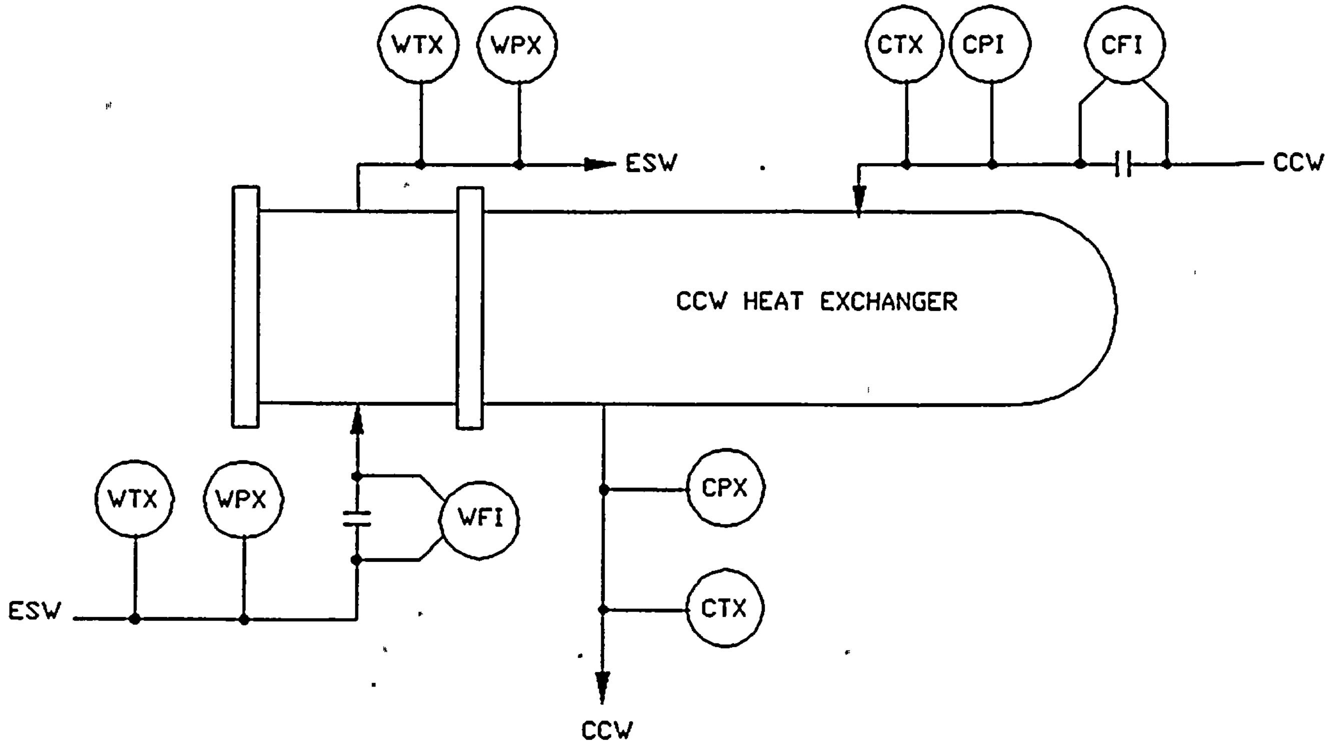
Review of practices, procedures, and training involving the service water system which are currently in-place in the operations, maintenance, and construction areas at Cook Nuclear Plant indicates compliance with this recommendation. Some specifics identified in the review include:

- <u>Operations</u> - The normal, abnormal, and emergency operating procedures associated with the open-cycle service water system have been reviewed within the past 18 months, and have been determined to ensure that the system functions as intended.

  Lesson plans were reviewed in the areas of requalification training, replacement training, and non-licensed operator training. They were determined to provide adequate background to allow personnel to perform competently with regard to operating the service water system and promptly identifying problems that may arise.

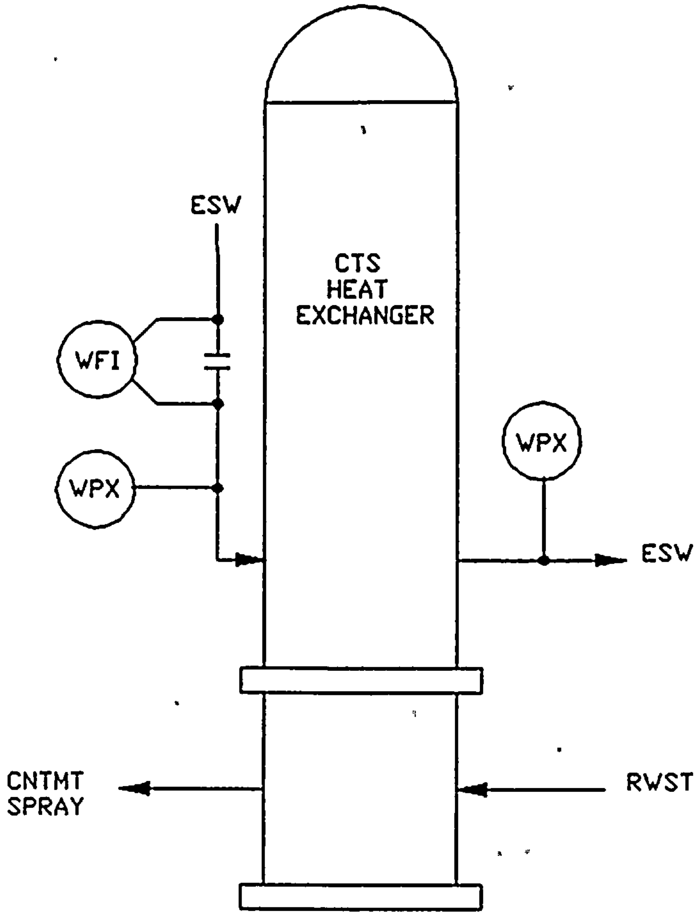
- <u>Maintenance</u> - A specific lesson plan emphasizing the function and importance of the ESW system has been part of the maintenance training program since 1986. While the current lesson plan is considered adequate, the training material will be augmented with the specific information and concerns addressed in Generic Letter 89-13 to provide further emphasis.

- <u>Construction</u> - Construction personnel follow approved plant procedures and receive appropriate training for the work they are performing. Review of work orders and QA audit/surveillances associated with construction work activities on the service water system indicates that procedural guidance and training have been adequate to ensure the integrity of the completed work.



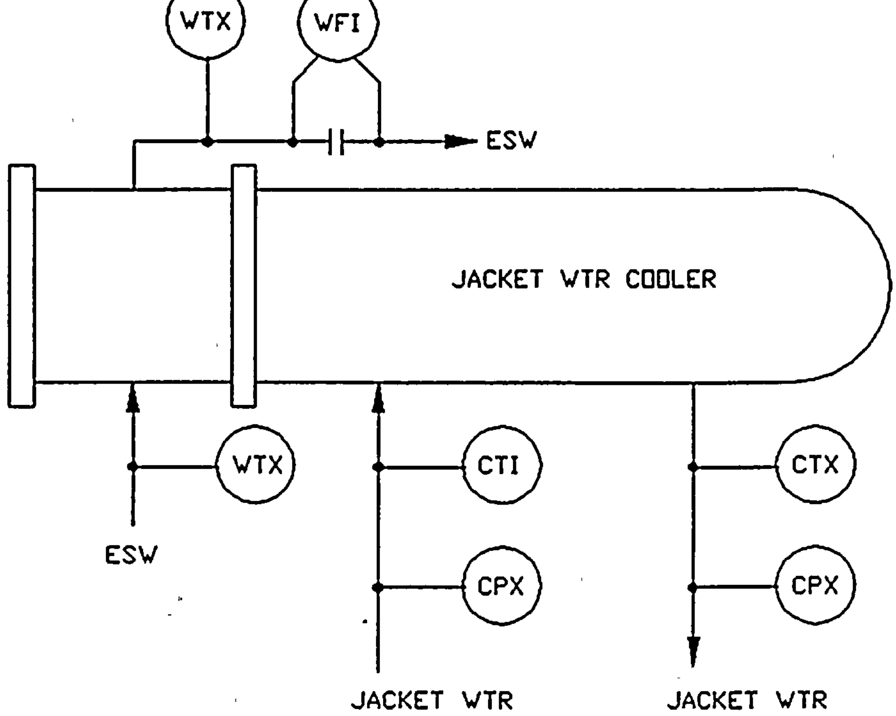
COOK NUCLEAR PLANT UNITS 1 & 2
COMPONENT COOLING WATER HEAT EXCHANGERS
FIGURE 1

An initial full functional heat transfer test will be performed on the CCW heat exchangers during shutdown for each unit's next refueling outage (Unit 2 - June 25, 1990, Unit 1 - October 25, 1990). The heat transfer test will consist of measuring the shell and tube side flows (CFI, WFI), temperatures (CTX, WTX), and pressures (CPI, CPX, WPX). This data will be used to compare actual heat exchanger performance to design conditions. Periodic testing will be conducted in a similar manner during the next three scheduled refueling outages on each unit.



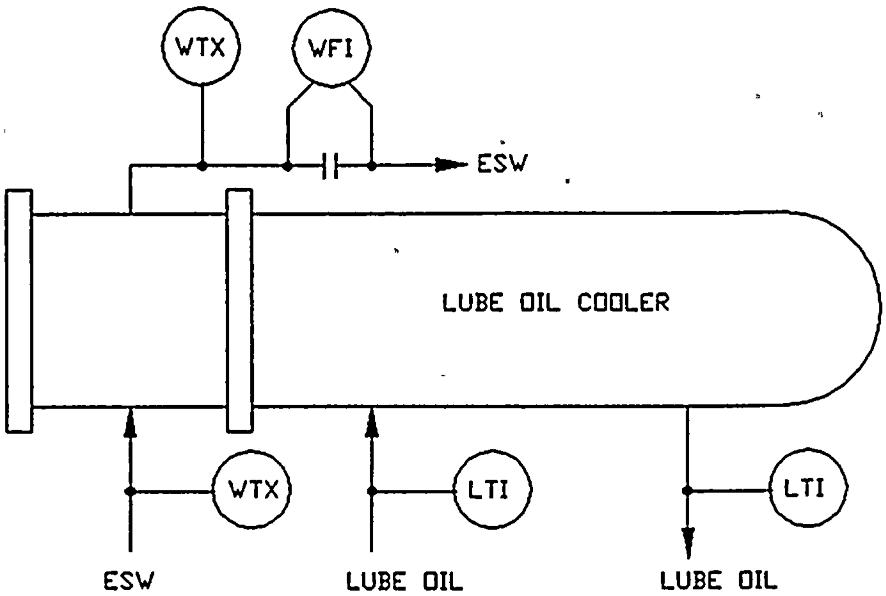
COOK NUCLEAR PLANT UNITS 1 & 2
CONTAINMENT SPRAY HEAT EXCHANGERS
FIGURE 2

A functional heat transfer test cannot be performed on this component since a heat source is not available during normal or shutdown operations. The monitoring program on this component, instead, will be based on trending the delta P across the heat exchangers (WPX) at a given flow (WFI). (See page 2 under Recommendation C of Enclosure 1.) Periodic testing will be conducted in a similar manner during the next three scheduled refueling outages on each unit.



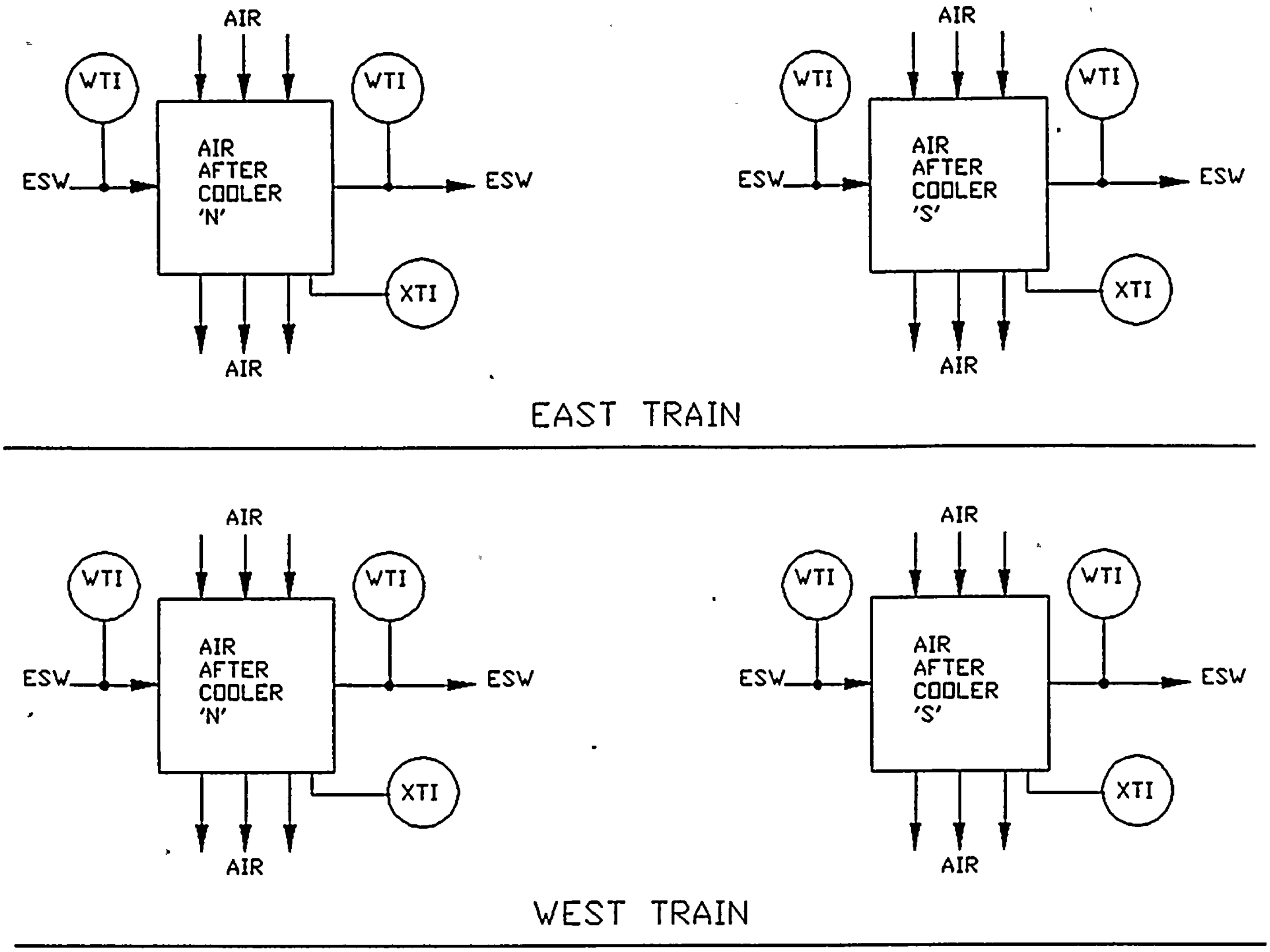
COOK NUCLEAR PLANT UNITS 1 & 2
EMERGENCY DIESEL JACKET WATER COOLERS
FIGURE 3

A functional heat transfer test cannot be performed on this component since the shell side flow cannot be measured. The monitoring program on this component will be based on a temperature trending program at a given test flow (WFI). Both shell and tube side temperatures (CTI, CTX, WTX) can be measured during the emergency diesel 18-month surveillance test. The temperatures obtained during this test can be compared to the design temperatures and performance trended. Periodic testing will be conducted in a similar manner during the next three scheduled refueling outages on each unit.



COOK NUCLEAR PLANT UNITS 1 & 2
EMERGENCY DIESEL LUBE OIL COOLERS
FIGURE 4

A functional heat transfer test cannot be performed on this component since the shell side flow cannot be measured. The monitoring program on this component will be based on a temperature trending program at a given test flow (WFI). Both shell and tube side temperatures (LTI, WTX) can be measured during the emergency diesel 18-month surveillance test. The temperatures obtained during this test can be compared to the design temperatures and performance trended. Periodic testing will be conducted in a similar manner during the next three scheduled refueling outages on each unit.



COOK NUCLEAR PLANT UNITS 1 & 2
EMERGENCY DIESEL AIR AFTER COOLERS
FIGURE 5

A functional heat transfer test cannot be performed on this component since the shell and tube side flows cannot be measured. The monitoring program on these components will be based on a temperature trending program. Both shell and tube side temperatures (XTI, WTI) can be measured during the emergency diesel 18-month surveillance test. The temperatures obtained during this test can be compared to the design temperatures and performance trended. Periodic testing will be conducted in a similar manner during the next three scheduled refueling outages on each unit.

ATTACHMENT 2 TO AEP:NRC:1104

ESW AND FIRE PROTECTION SYSTEMS
APPLICABLE PORTIONS OF COOK NUCLEAR PLANT UFSAR

9.8 FACILITY SERVICE SYSTEMS

The Facility Service Systems consist of the Fire Protection Systems, the Service Water System, and the Compressed Air System.

9.8.1 FIRE PROTECTION SYSTEM

Introduction

The information presented in Section 9.8-1 provides a general discussion of the various fire protection systems at Cook Nuclear Plant. In addition, references to specific documents have been provided to address different facets of the Fire Protection Program in greater detail. These documents are:

- o Fire Hazards Analysis.
- o Safe Shutdown Capability Assessment, Proposed Modifications, and Evaluations (SSCA).

The Fire Hazards Analysis provides a zone-by-zone analysis of the fire hazards and the effects of a postulated fire at Cook Nuclear Plant in accordance with the branch technical position APCSB 9.5-1. The SSCA provides a summary and the results of the analysis of the Cook Nuclear Plant to the requirements of 10 CFR 50, Appendix R (specifically, Sections III.G, J, and O of Appendix R).

Analyses have been performed for the specific requirements of Appendix R, Section III (alternate shutdown), which confirm the capability to safely bring the reactor from full power operation to cold shutdown within 72 hours.

Design Bases

The fire protection system is designed to achieve the following objectives:

a) Provide automatic fire detection in those areas where the fire danger is greatest.

b) Provide fire extinguishment by fixed systems of the water, Halon 1301, or carbon dioxide type and actuate automatically or manually in those areas where the fire danger is greatest.

c) Provide manually operated fire extinguishing equipment including fire hose reels capable of using water, foam, or carbon dioxide as the fire fighting agent, and portable equipment of the wheeled and hand carried type for use by personnel at all points throughout the property.

d) The fire protection system is designed to equal or exceed the standards of the National Fire Protection Association and the American Nuclear Insurers.

System Design and Operation

The Fire Protection System is shown in Figures 9.8-1 and 9.8-2. The indoor fire protection header piping is designed in accordance with USAS B31.1 classification.

The fire protection system includes the following:

a) Unit No. 1 motor-driven, low-demand fire pump.
b) Unit No. 1 motor-driven, high-demand fire pump.
c) Unit No. 1 diesel-engine-driven fire pump.
d) Unit No. 2 motor-driven, high-demand fire pump.
e) Unit No. 2 diesel-engine-driven fire pump.
f) Yard hydrant fire system.
g) Indoor plant standpipe and fire header system.
h) Low pressure CO_2 systems.
i) Low pressure CO_2 hose reel system.
j) Fire alarm horns and annunciators.
k) Various water type fire fighting systems.
l) Halon 1301 systems.

Components

Pumps

a) Two electric-motor-driven fire pumps, each of 2000 gpm capacity; two diesel engine-motor-driven pumps, each of 2000 gpm capacity; a 500 gpm electric pump and 50 gpm pegging pump are provided.

b) The 2000 gpm electric-motor-driven pumps are installed in the turbine building pump bay at opposite ends of the room in their respective units. The normal electrical supply is from 600 v a-c buses which are capable of being supplied from the diesel generators.

c) Each 2000 gpm diesel-engine-driven pump is located in its own room within the screen house. Each diesel engine has an independent (a) fuel system capable of 8 hours operation and (b) battery-powered starting circuits equipped with automatic battery charging equipment.

d) The 500 gpm electric-motor-driven pump is located on the Unit No. 1 side of the turbine building pump bay and is capable of being supplied from the diesel generators.

e). The 50 gpm electric-motor-driven pegging pump is located on the Unit No. 1 side of the turbine building pump bay. Its sole purpose is to maintain pressure in the fire protection piping system.

f) Relief valves are installed in the discharge piping of both diesel-driven pumps.

Pump Control

a) All pumps are arranged for (1) automatic starting by operation of pressure sensing devices or fixed fire protection systems, (2) automatic starting from a fire switch in either control room, (3) remote manual start of the Unit No. 1 fire pumps from switches in the Unit No. 1 control room and of the Unit No. 2 pumps from the Unit No. 2 control room and (4) locally starting at each pump. They cannot be shutdown until extinguishment of a fire is verified by the control room of the unit involved in the fire.

b) All pumps except the pegging pump are arranged to start in sequence to prevent massive surge pressures should all pumps start simultaneously. Operation of a hose line or small sprinkler system starts the 500 gpm electric pump.

If more water is required, the high demand fire pump from the appropriate unit will be started first by the logic system. Operation of a fixed system such as a transformer water spray or basement sprinkler system immediately starts the appropriate unit's high demand fire pump. Table 9.8-1 lists this sequence.

Pump Suction

a) The high-demand, electric fire pumps' suction source is from their respective units' circulating water discharge tunnel. The low-demand pump suction source is from the Unit 1 discharge tunnel. The diesel-engine-driven fire pump suction source is from the circulating water intake at the screen house. Self cleaning strainers are provided at the pumps' discharge line to remove foreign material from the water. Pressure differential manometers provide control room alarm if a strainer clogs.

b) Water supply for the 50 gpm pegging pump is provided by a connection to the plant non-essential service water system.

Water Distribution

a) The water from the fire pumps is distributed to an outside, buried loop header and an interior loop header in the turbine room basement.

b) The outdoor header consists of 12-inch pipe with 5 1/2 feet of earth cover for freeze protection. Isolating valves with post indicators or curb boxes are installed in this header so that the entire loop is not disabled should maintenance be required on a small section.

c) Fire hydrants are installed at regular intervals on the outdoor fire header. Each hydrant has its own buried 6-inch control valve, two 2 1/2-inch hose connections and a 4 1/2-inch pumper connection. Hose cabinets containing hose, nozzles, and fittings are associated with several of these hydrants.

d) A 10-inch interior loop header is located in the turbine and screenhouse buildings. This interior header is connected to the outdoor loop header by valved connections routed through the

service building, auxiliary building and the yard. This arrangement forms a series of smaller interior-exterior loops. The interior piping network is equipped with isolating valves and supplies water to the fixed fire protection and standpipe systems.

e) Each of the fixed fire protection system valve manifolds is equipped with a manual valve to allow periodic flushing of the headers to remove silt and foreign material in the piping.

f) The standpipe connections are 2, 2 1/2 or 3 inches in size. The 2 and 2 1/2-inch connections are furnished with 1 1/2-inch hose valves. A 1 1/2-inch fire hose on a storage reel is directly connected to the 1 1/2-inch hose valve. The 3-inch connections are furnished with two hose valves, one 2 1/2-inch and one 1 1/2-inch size. The 2 1/2-inch valve is provided with a reducer to a 1 1/2-inch hose cap. The 1 1/2-inch valve is used for direct connection of the 1 1/2-inch fire hose on the storage reel.

<u>Outside Plant Protection</u>

a) The major piece of fire apparatus for outside plant protection is a 500 gpm capacity four wheel drive fire truck.

This truck carries: (a) 400 gallons of water in its booster tanks, (b) 500 feet of 2 1/2-inch and 500 feet of 1 1/2-inch fire hose, (c) straight stream, water spray, and foam fire hose nozzles in both the 2 1/2- and 1 1/2-inch sizes, (d) 15 gallons of 3% mechanical foam in a built-in tank as well as several 5 gallon cans, (e) a 24-foot extension ladder, (f) pike pole axes, and wrenches, (g) a 100 gpm portable gasoline engine driven pump, (h) a gasoline engine driven generator with portable spot and floodlights, (i) self-contained breathing apparatus and protective clothing, (j) miscellaneous equipment such as fittings, siamese and wye connections, strainers, suction hose, hose valves, battery operated lights, portable extinguishers and smoke ejectors.

c) The office building is partially protected by a standard wet pipe sprinkler system on an ordinary hazard spacing similar to the service building. The telephone equipment and record storage rooms on the second floor of the office building and the file storage room in the basement are protected by 7-1/2 ton capacity low pressure carbon dioxide systems. The systems are actuated by ionization type fire detectors. The carbon dioxide storage tank can also be used for generator purging operations through vaporizers. The security equipment room is protected by an automatic halon system.

d) Where fire detection in the office and service building is provided, it is accomplished by ionization type systems which detect products of combustion. These systems annunciate in the control room. In areas such as the truck unloading docks where engine exhaust gases could cause false alarms, thermal detectors are used.

e) Miscellaneous gas cylinders are stored in a semi-detached gas cylinder storage building located on grade south of the Unit 2 turbine building. Overflow storage of gas cylinders will be in an open-air shed adjoining the office building. This shed is protected by a water spray deluge system of the dry pilot-operated type. The system consists of a deluge valve held in the closed position by the action of compressed air on a diaphragm.

The air is contained in small diameter piping by standard sprinkler heads which act as fixed temperature detectors.

When a sprinkler detector opens, the air in the pilot piping is released, causing the deluge valve to open. Nozzles at the gas bottle shed are of the open type. Pressure-operated switches on the deluge valve trim piping operate to give control room annunciation, sound the control room alarm and start the appropriate fire pump. Manual operating stations are also provided.

f) The roadway under the office building overhang on the lake side of the building is protected by a water spray deluge system activated by electric detection similar to that described below for the transformers. This is done to protect against the possibility of a vehicle fire in the area damaging the office building.

g) While not part of the office/service building, the hydrogen tube bank, used to store hydrogen for generator cooling, is also protected by a water spray deluge system of the dry pilot-operated type similar to the miscellaneous gas cylinders.

Fixed Water Systems-Transformers

The main step-up, unit auxiliary and start-up transformers are all protected by individual open nozzle deluge water spray systems. All systems are electrically actuated by continuous-strip thermistor detection units which open the deluge valve, give control room annunciation, sound the control room alarm, and start the appropriate fire pump. The system is electrically supervised so that failure of the actuation solenoid or detection circuit results in control room annunciation. Manual operating stations are also provided. In addition, the turbine room wall adjacent to the main transformers is sprayed simultaneously with a main transformer water spray operation.

Fixed Systems-Turbine Generator Building

A. Basement and Mezzanine Floors

1. The floor areas under the generator ends and hydrogen seal oil units are protected by standard wet pipe sprinkler systems on extra hazard spacing. The diesel generator ramp/corridors are also protected by these sprinkler systems using ordinary hazard spacing. The systems consist of variable pressure alarm

b) The 345 kV and 765 kV switchyards are provided with 150-pound dry chemical wheeled extinguishers and/or 20-pound dry chemical or 15-pound CO_2 hand portable extinguishers.

Inside Plant Portable Equipment

a) Fire hose and various type nozzles are provided for manual fire fighting in the event of large indoor fires. This equipment is located at 75 to 100-foot spacings around the perimeter of the turbine generator building and at critical locations in the service and auxiliary buildings.

Each location consists of a hose reel, containing 75 to 100 feet of 1 1/2-inch fire hose and an adjustable water spray nozzle. In certain locations adjustable stream foam nozzles along with 5-gallon cans of 3% mechanical foam concentrate are provided. In some locations a second hose reel with up to 100 feet of 1 1/2-inch fire hose is also provided. This second hose reel is not connected to the standpipe system.

b) Wheeled dry chemical extinguishers are provided in the turbine room basement and on the turbine room main floor. The units on the main floor are equipped with special nozzles for use with quick couplers for fire fighting at the turbine bearings.

c) Hand portable extinguishers are provided in sufficient quantities to limit the distance a user need travel to obtain a unit of this type. Sizes and types of extinguishers used are 20-pound cartridge operated dry chemical, 20-pound cartridge operated all-purpose dry chemical, 15-pound carbon dioxide and 20-pound halon. Inside the lower volume of the containment, 20-pound cartridge operated all-purpose dry chemical extinguishers with brass fill caps are provided. They are secured on vehicle mounting brackets.

d) Self-contained breathing apparatus are located at critical points where fire fighting personnel must enter the various buildings and in the control rooms. The breathers used are the positive pressure type and have a one hour duration regardless of the user's level of activity. With off-shelf and cascade recharging equipment, a 5-man fire brigade team can be supported for 8 hours duration.

e) Hand portable battery operated spotlights complement the breather apparatus to allow personnel to find their way in smoke charged atmospheres.

f) Portable radios have been provided for fire brigade members.

Fixed Systems Office/Service Building

a) The service building is protected by a standard wet pipe sprinkler system on an ordinary hazard spacing. The system consists of a variable pressure alarm check valve with a retarding chamber and sprinklers of suitable temperature rating. A pressure switch on the retarding chamber, on increase of pressure, operates to give control room annunciation, activates the control room alarm and starts the appropriate fire pumps. Areas protected include storage areas and racks, machine shop, and miscellaneous rooms.

The miscellaneous oil storage room is protected by a standard sprinkler system on an extra hazard spacing but otherwise the same as described above for the storeroom.

b) The service building extension is partially protected by a standard wet pipe sprinkler system on an ordinary hazard spacing similar to the service building. The QC record storage room on the fourth floor is protected by an automatic halon system.

check valves with retarding chambers,and sprinklers of the suitable temperature rating. Pressure switches on the retarding chambers operate on pressure increase to give control room annunciation, sound the plant fire horn system, and start the appropriate fire pumps.

2. The floor areas under the turbine head ends are protected by wet pipe sprinkler systems. The design density of these systems is to provide 0.30 gpm per square foot of net floor area. Pressure operated switches on the alarm valve retard chamber operate to start the appropriate fire pumps, sound the plant fire horn system, and give control room annunciation.

3. Cable racks in the turbine room basement and mezzanine floor are protected by wet pipe sprinkler systems using wide angle sealed water spray nozzles. The same systems also protect the lubricating oil piping from below the main floor at each bearing to the main lubricating oil tanks with nozzles separate from those protecting the cable racks.

   The systems are controlled by variable pressure alarm check valves operating in a similar fashion to those described in "1" above.

4. Oil piping above the main floor under the appearance lagging of the turbine is protected by closed head sprinkler systems which are manually operated from the respective control rooms. Fire detection, for alarm only, is by continuous strip thermistor which annunciate in the control rooms.

5. The Turbine Driven Auxiliary Feed Pumps are protected by wet pipe sprinkler systems on extra hazard spacing similar to those described in "1" above. The interconnecting pump corridor is also protected by the Unit 2 sprinkler system using ordinary hazard spacing.

6. The heating boiler rooms and the Unit 1 crane bay are protected by wet pipe sprinkler systems similar to those described in "1" above. On elevation 591', emphasis is given to provide coverage at the face of the boiler where the oil lighters and burners are located. The back-up heating boiler on elevation 609' has been removed along with the sprinkler coverage that protected the burner front.

7. Ionization smoke detection systems are provided for the following areas:
   a. Diesel Generator ramp/corridor (Units 1 & 2)
   b. Auxiliary Feed Pump corridor (common to both Units)

B. Main Floor

1. The turbine bearings are protected by manually-operated dry chemical systems. These systems consist of nozzles at each bearing. The piping that supplies the nozzles is terminated at a safe location with a quick coupler. One hundred twenty-five or 300-pound capacity wheeled dry chemical extinguishers fitted with quick couplers are connected to the piping system and discharged as required.

2. The Technical Support Center is outside the Unit 1 and 2 control rooms. All rooms contain ionization detectors. In addition, the consultation rooms are protected by a wet-pipe sprinkler system. The console room and underfloor, the computer room and the uninterruptable power supply (UPS) inverter room are protected by Halon 1301. Operation is by cross-zoned ionization detectors. The charcoal filter equipped air handling unit for the Technical Support Center is provided with a manual water spray deluge system to extinguish the charcoal filter fire. Continuous strip thermistor detection provides a high temperature alarm in the Unit 2 control room and automatically opens the system deluge valve. The control valve to the water spray system must then be manually opened to fight the fire.

C. Screen House

1. The two diesel fire pump rooms are protected by wet-pipe sprinkler systems. The systems consist of alarm check valves with retarding chambers and sprinklers of suitable temperature ratings. Pressure switches on the retarding chambers operate on pressure increase to give control room annunciation, sound the plant fire horn, and start the appropriate fire pump.

2. Ionization smoke detection systems are provided for the following:
    a. MCC Room for ESW, Basement Area - Elevation 575' (common to both Units)
    b. ESW Pump and MCC Rooms - Elevation 591' (Units 1 and 2)

Auxiliary Building

A 6-inch size welded steel fire protection water header supplying fire hose reels and sprinkler valves is routed through the auxiliary building. This header is isolated by remotely-operated valves outside of the auxiliary building on the east side and in the turbine generator building.

The header is not pressurized but is kept full of water. If it is desired to use one of the hose reels, the operator must actuate a local pushbutton which opens the valves to admit full header pressure. The valves can be closed by the control room operator after the emergency situation has been cleared up. Automatic sprinkler or deluge system operation also will open the remotely-operated isolation valves.

Because of the possibility of accumulations of Class A combustibles in the drumming area, this area is protected by a preaction sprinkler system on ordinary hazard spacing similar to the service building miscellaneous gas bottle shed, except that the nozzles are closed sprinklers. Similar dry pilot preaction sprinkler systems are also installed in the auxiliary building in the following areas: a) under the roof over the new fuel

receiving area to protect all shipments of new fuel before transfer to the new fuel storage room, b) floor elevation 587' over normally accessible areas and in the charging and safety injection pump rooms, and to provide protection for the open stairways leading to elevations 573' and 609', c) floor elevation 609'over normally accessible areas and the component cooling water pump area (protected by extra hazard sprinkler spacing and direct closed spray nozzle application onto the pumps), and to provide protection for the open stairways leading to elevation 633', and d) floor elevation 633' over normally accessible areas (excluding the HVAC vestibule areas), and to provide protection for the open stairways leading up to elevation 650'. The sprinklers for the new fuel receiving area are baffled by the roof steel to prevent water discharge into the spent fuel pool.

The Unit 2 control room cable vault is protected by a wet-pipe sprinkler system. The system has a variable pressure alarm check valve with a retarding chamber and sprinkler of the suitable temperature rating. Pressure switches on the retarding chamber operate on pressure increase to give control room annunciation, sound the control room alarm, and start the appropriate fire pumps.

All charcoal filter equipped air handling units in the auxiliary building and for the control rooms are provided with manual water spray deluge systems to extinguish the charcoal filter fire. Continuous strip thermistors provide detection and a high temperature alarm in the associated control room. A detection alarm also sends a signal to open the isolating valves in the auxiliary building supply header and automatically opens the charcoal filter system valve. The control valve to the affected charcoal filter water spray system is then manually opened to fight the fire.

Hydrogen tubes outside the auxiliary building are equipped with a water spray dry pilot deluge system similar to that provided at the office/service building hydrogen tubes.

Ionization fire detection is provided on each floor of the auxiliary building for general alarm of fire as follows:

Elev. 573' a. Containment Spray and Residual Heat Removal Pump Cubicles (Units 1 and 2)
b. Normally accessible common areas of the Auxiliary Building

Elev. 587' a. Transformer Rooms (Units 1 and 2)
b. Sampling Room (common to both units)
c. Spray Additive Tank Room (common to both units)
d. Charging and Safety Injection Pump Cubicles (Units 1 and 2)
e. Drumming/Drum Storage (common to both units)
f. Normally accessible common areas of the Auxiliary Building

Elev. 609' and 612' a. Access Control (common to both units)
b. AB and CD (EL 625'-10") Battery Rooms (Units 1 and 2)
c. El. 617' Valve Gallery (common to both units)
d. NESW Valve Gallery (Units 1 and 2)
e. Normally accessible common areas of the Auxiliary Building

Elev. 633' a. New Fuel Storage Room (common to both units)
b. N-Train Battery Rooms (Units 1 and 2)
c. Normally accessible common areas of the Auxiliary Building

Elev. 650' a. Control Room Equipment Rooms (Units 1 and 2)
b. Normally accessible common areas of the Auxiliary Building

A combination of ionization and infrared detectors are provided in the Main Steam Valve Enclosures East and Main Steam Line Area of Units 1 and 2 at elevation 612'.

Reactor Containments

Containment cable trays, reactor coolant pumps and HVAC charcoal filters are equipped with continuous strip thermistor fire detection which will annunciate in the control rooms.

The HVAC charcoal filters have water spray deluge fire suppression systems and are actuated by the thermistor detection.

Reactor coolant pumps are equipped with preaction water spray systems, manually operated from the control rooms in the event of a lubricating oil fire. Additionally, the RCP motors are provided with an oil spillage control and retention system to preclude spreading oil from a pressure or gravity type leak.

Water supply to containment fire protection is from the non-essential service water system.

Low-Pressure Carbon Dioxide System

A 17-ton capacity low-pressure carbon dioxide system, located in the auxiliary building, is provided for automatic and/or manual protection of various areas as listed below. The amount of CO_2 in the system is sufficient to protect the largest single hazard in the plant. The CO_2 is stored in an insulated pressure vessel having an automatically operated refrigeration system. Operation of the CO_2 systems is annunciated and ~~they~~ activates the control room alarm system.

The areas protected by the low-pressure CO_2 system and the type of fire detection are as follows:

1. Turbine-Generator-Building

   a) Lubricating oil storage rooms Units No. 1 and No. 2. Continuous-strip thermistor detection.
   b) Main turbine oil tank rooms Units No. 1 and No. 2. Continuous-strip thermistor detection.

2. Auxiliary Building

   a) AB and CD emergency diesel generator rooms Units No. 1 and No. 2. Continuous-strip thermistor detection. (2 zones for each room)

b) Diesel oil pump and valve station rooms Units No. 1 and No. 2. Continuous-strip thermistor detection.

c) Electrical switchgear rooms Units No. 1 and No. 2.
   1. 4.16 kV switchgear rooms. Infrared and ionization detection.
   2. 4.16 kV/600 V transformers and engineered safety equipment rooms. Infrared and ionization detection.
   3. 4.16 kV/600 V transformers, control rod drive and inverter rooms. Infrared and ionization detection.

d) Electrical switchgear room cable vaults Units No. 1 and No. 2. Infrared and ionization detection.

e) Auxiliary cable vaults Units No. 1 and No. 2. Ionization detection.

f) Control room cable vaults Units No. 1 and No. 2. Manual (backup to Halon 1301 systems).

g) Electrical penetration area cable tunnels Units No. 1 and No. 2.
   1. Quadrant 1. Infrared and ionization detection.
   2. Quadrant 2. Infrared and ionization detection.
   3. Quadrant 3 north. Infrared and ionization detection.
   4. Quadrant 3 middle. Infrared and ionization detection.
   5. Quadrant 3 south. Infrared and ionization detection.
   6. Quadrant 4. Infrared and ionization detection.

3. Carbon dioxide hose reel stations are provided for manual fire fighting in the auxiliary building, switchgear rooms, and

at the entrances to the control rooms, diesel generator rooms, and electrical penetration area cable tunnels.

Halon 1301 Systems

Halon 1301 systems are provided for automatic fire protection in various areas of the plant. Locations of these systems include the control room cable vaults, the computer rooms and underfloor, control points for the Plant Security System, and as previously mentioned, the service building extension QC record storage room, TSC computer room, TSC console room and the TSC UPS inverter room. Actuation is by two zones of ionization detection for each system.

Control Room Fire Protection

The control rooms are equipped with portable fire extinguishers. Detection systems of the ionization type are installed. The control rooms are occupied at all times by operators who have been trained in fire extinguishing procedures. All areas of the control rooms are accessible for fire fighting.

Miscellaneous Protective Features

a) Transformer decks are pitched and drained to remove oil which may be spilled from a fire-involved transformer and also to remove water discharged from the transformer water spray system.

b) The construction of most exterior and interior building walls equal or exceed fire rating requirements. Openings in walls which require fire rating are provided with appropriately rated doors, dampers and penetration fire seals. When rated components are not installed in a fire wall separating fire areas, technical evaluations are performed justifying the configurations.

c) To remove heat and smoke from under the turbine room roof and the service building storeroom roof, automatic smoke and heat vents are provided in the ratio of 1 sq. ft. of vent area to 100 sq. ft. of roof area. The vents in the auxiliary building roof were originally provided for removal of heat and smoke; however, for health-physics reasons, these vents are normally held closed to prevent their use.

d) Many of the plant ventilating fans are arranged so that they may be shutdown on actuation of an automatic fire system to prevent spread of fire or smoke or, in the case of CO_2 or Halon-protected areas, to retain an extinguishing concentration of the fire fighting agent. The same fans can be used for smoke removal upon realignment of the HVAC system.

e) In case of a fire, smoke and gases are kept outside the control room by sealing all openings and by a pressurization system which draws air from outside. To further assure the purity of the pressurization air, filters are installed to remove smoke.

f) The plant fire horn alarm system, consisting of motor-operated horns, is provided throughout the plant to alert personnel of a fire. These horns are distinctly different in sound from the evacuation siren system.

In general, the control room alarm is started automatically by operation of the fixed systems. Manual operation of the plant-wide system is done from the control rooms by the plant operators.

g) Fire protection functions are displayed on a comprehensive annunciator panel in the control rooms to alert the operator in case of fire, fire system operation, or fire system malfunction. Pressure gauges on the panel also tell the operator the pressure conditions in the fire protection water piping headers.

h) In order to limit the spread of burning oil from a turbine room fire, curbs are installed in areas where lubricating oil is stored and piped to bearings, seal oil units, and main oil tanks.

i) Cable tray, pipe, and similar openings in areas requiring fire rated walls, floors, and ceilings are sealed with noncombustible silicone sealants to prevent spread of fire and loss of gaseous fire fighting agents and in the case of the control rooms, to prevent air infiltration. Open penetrations in fire rated barriers may exist for areas where acceptable deviations from the guidelines of Appendix A to BTP APCSB 9.5-1 have been granted by the NRC (such as for the seismic gaps) or when engineering evaluations are provided.

Design Evaluation

Since the four main fire pumps are widely separated from each other both in space and by the ability to isolate a given pump and its section of header in the event it is damaged, it is highly unlikely that the entire pump and piping system will ever be lost. The four main fire pumps are so sized that any two of them can supply the water demand for the largest single hazard anticipated.

The fire protection system is so designed that the fire equipment for the two units is cross connected, both electrically and hydraulically. Any pump is capable of supplying water to any automatic system, regardless of unit, and either control room can automatically control all pumps. However, it is also possible to completely isolate one unit from the other hydraulically and electrically and operate each independently. In this manner, the equipment from one unit can be used and support the other unit, but should severe damage occur to the fire system in one unit, the fire system for the other unit can be isolated and will continue to function.

Tests and Inspections

Fire protection/detection equipment is periodically tested in accordance with Technical Specification requirements to insure proper performance when required. In addition, appropriate surveillance and tests are performed on all portable equipment to insure that it is properly located, charged, and in good working condition.

Fire drills are held regularly to maintain the fire fighting capability of the plant fire brigade at a high level.

9.8.2 COMPRESSED AIR SYSTEM

The Compressed Air System is shown on Figure 9.8-3.

9.8.2.1 Design Bases

Parameters included in design:

1. The system must provide redundant compressed air supplies for control and instrument air requirements.

2. The system must provide adequate compressed air capacity for:

   a. General Plant Service
   b. Control
   c. Instrumentation
   d. Testing
   e. Containment Penetration and Weld Channel Pressurization System
   f. Respiratory protection in the containment structure itself, as per compressed gas association commodity Spec. G-7.1 - 1966, per OSHA Standards and Interpretations 1910.134.

3. The system must provide a continuous supply of compressed air to vital systems under both normal and abnormal conditions.

9.8.2.2 System Description

The Compressed Air System includes the combined service and control instrument air sub-systems, the air supply for the Containment Penetration and Weld Channel Pressurization System and air respiratory protection at strategic location. Either of the two full capacity plant

The discharge strainers of the pumps are of duplex construction, with automatic backwashing. Each strainer is effectively two strainers in one casing with flow directed through one half, while slide gates block off the other half. When the strainer is in service and if it becomes dirty or clogged, a high differential pressure signal initiates a shift of the slide gates blocking the flow to the dirty basket and directing it through the clean basket. The dirty basket is then backwashed and is ready for re-use within 90 seconds.

Essential Service Water System

The Essential Service Water (ESW) System supplies cooling water to the following components:

a. Component Cooling Heat Exchangers
b. Containment Spray Heat Exchangers
c. Emergency Diesel Generators
d. Auxiliary Feedwater System
e. Control Room Air Conditioners

During normal operations essential service water is supplied continuously to the Component Cooling Heat Exchangers and the Control Room Air Conditioners while the Containment Spray Heat Exchangers and the Emergency Diesel Generators are supplied only when these systems are in operation. In addition, the essential service water system serves as back-up water sources to the auxiliary feedwater pumps for use when the condensate storage tank, the normal supply for the auxiliary feed-water system, is either empty or otherwise lost as a source of supply.

The system consists of four essential service water pumps, four duplex strainers and associated piping and valves. System piping is arranged in two independent headers, each serving certain components in each unit as follows:

a) Each essential service water header supplies cooling water to one of the two Containment Spray Heat Exchangers associated with each unit.

b) The heat exchangers for the two diesel-generator sets on each unit are served by both essential service water headers on that unit, one a normal and one a standby supply.

c) Each essential service water header supplies cooling water to one of the two Component Cooling Heat Exchangers associated with each unit.

d) In each unit one essential service water system provides the source of feedwater for the turbine-driven auxiliary feed-water pump and the other to both motor-driven auxiliary feed pumps.

e) Each essential service water header supplies cooling water to one of the two Control Room Air Conditioners associated with each unit.

The two headers are arranged such that a rupture in either header will not jeopardize the safety functions of the system. Each header is served by two essential service water pumps. Two pumps are sufficient to supply all service water requirements for unit operation, shutdown, refueling or post accident operation, including a LOCA on one unit and a simultaneous hot shutdown in the other. However, a third pump is normally started under the shutdown and refueling operations. All pumps receive a start signal in the event of an accident.

Since the thermal load on the Component Cooling Water Heat Exchangers is reduced after a safety injection signal, the Essential Service Water flow to these heat exchangers is automatically reduced to insure

adequate flow to the Containment Spray Heat Exchangers if needed. Flow is automatically supplied to the Containment Spray Heat Exchangers during the recirculation mode if a containment spray signal has been initiated. When it has been established that sufficient Essential Service Water Pumps have started, full design flow will be established to both Component Cooling Water Heat Exchangers. The header and valving arrangement insures adequate service water flow under all normal and emergency conditions. Design flow rates for the Essential Service Water System are tabulated in Table 9.8-5.

The Essential Service Water Pumps take suction from a separate section of the screenhouse which cannot be isolated from the lake. As described in Sub-Chapter 10.6, lake water is supplied to the screenhouse forebay by three 16 foot diameter pipes which terminate approximately 2250 feet from shore. It is inconceivable that damage from barge or ship accidents or even natural phenomena could totally isolate these three pipes; however, motor operated sluice gates which normally separate the discharge from the intake can be opened providing another access to the lake. Furthermore, the maximum demand for the ESW system is only slightly more than one percent of the total circulating water system during normal operation.

The pumps are designed to operate as Class I equipment, with the motor drives located above the maximum flood level. The pump motors can be supplied with power from normal or emergency sources, thereby insuring a continuous flow of service water under all conditions.

ESW system leakage in the auxiliary building, which is small enough not to be accurately detected by the ESW system flow meters, drains to the various sumps in the auxiliary building. Level alarms in these sumps annunciate in the control room alerting the operator. Visual inspection is used to determine the actual location.

For the detection of large leaks, the Essential Service Water System is equipped with flow, differential flow, and pressure alarms and/or indicators which will signify losses from the supply headers. In addition, flow indicators are located in the Essential Service Water lines for each Component Cooling and Containment Spray Heat Exchanger as well as each Diesel Generator. The header supply valves are remotely operated, facilitating isolation of the supply header or pump which has failed.

9.8.3.3 Design Evaluation

Non-Essential Service Water System

The Non-Essential Service Water System is not required for the maintenance of plant safety related functions in the event of an accident. During normal operation, the system remains functional even if one Unit is out of service and its circulating water tunnels are dewatered.

Essential Service Water System

The Essential Service Water System is designed to prevent any failure in its system from curtailing normal plant operation or limiting the ability of the engineered safeguards to perform their functions in the event of an accident. Since the Essential Service Water System is required for long term heat removal, it is designed to withstand a passive failure on a long term basis. Although it is not a design requirement, the Essential Service Water System has sufficient capacity to handle a LOCA on one unit and hot shutdown in the other considering the single failure criterion. Sufficient pump capacity is included to provide design service water flow under all postulated conditions. The headers are arranged such that even loss of a complete header does not jeopardize plant safety related functions. Table 9.8-6 gives a malfunction analysis of a pump, valve and strainer.

9.8.3.4 Tests and Inspections

System components were hydrostatically tested prior to station startup and are accessible for periodic inspections or tests during operation. Electrical components, switchovers, and starting controls are tested periodically.

The essential service water pumps, valves and components are periodically tested in accordance with the applicable edition of the ASME Boiler & Pressure Vessel Code Section XI. Periodic testing of the non-essential service water pumps is conducted in accordance with normal industry practice.