November 20, 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No. 50-400-LA
	)	
(Shearon Harris Nuclear Power Plant)	)	ASLBP No. 99-762-02-LA

SUMMARY OF FACTS, DATA, AND ARGUMENTS ON WHICH APPLICANT PROPOSES TO RELY AT THE SUBPART K ORAL ARGUMENT REGARDING CONTENTION EC-6

VOLUME 2

EXHIBITS 2-5

EXHIBIT 2

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AFFIDAVIT OF ROBERT K. KUNITA

COUNTY OF WAKE	)
	) ss:
STATE OF NORTH CAROLINA	)

I, Robert K. Kunita, being sworn, do on oath depose and say:

1. I am a resident of the State of North Carolina. I am employed by Carolina Power & Light Company ("CP&L") and work at the Harris Nuclear Plant ("HNP" or "Harris Plant" or "Harris") in the Spent Fuel Management Subunit of the Environmental and Radiation Control Unit. Presently, I am a Principal Engineer, Spent Fuel Management. My business address is 5413 Shearon Harris Road, New Hill, North Carolina 27562-0165.

2. I hold a Bachelor of Science degree in Physics from the Illinois Institute of Technology and a Masters of Science degree in Nuclear Science and Engineering from Carnegie Mellon University. Since graduation, I have been employed by the Bettis Atomic Power Laboratory ("Bettis") and CP&L. At Bettis, from 1966 to

1973, I was a member of the nuclear core design team for Admiral Rickover's Light Water Breeder Reactor Project, which subsequently ran successfully at the Shippingport Reactor. I performed computerized nuclear design calculations and participated in fuel design changes to optimize breeding while safely generating reactor power.

3. Since joining CP&L in 1973, I have held several positions of increasing engineering responsibility. From 1973 to 1975, I was in the Power Plant Engineering Section responsible for the nuclear fuel related systems for the planned South River Nuclear Power Plant. In 1975, I transferred to the Nuclear Fuel Section of the Fuel Department, where my responsibilities included interfacing with the Harris Nuclear Plant project on matters relating to nuclear fuel and I began participating in fuel examinations at the Robinson Nuclear Plant.

4. From 1977 to 1988, I was the Principal Engineer and head of the Surveillance and Accountability Unit. My responsibilities included assuring adequate nuclear fuel mechanical design, monitoring nuclear fuel mechanical performance, providing thermal-mechanical fuel analysis, planning for spent fuel storage and transportation, and providing fuel related support to CP&L's nuclear plants. During this time my focus on zircaloy clad fuel in-reactor performance, fuel examination efforts, and fabrication of zircaloy clad fuel continued. Fuel performance improved significantly over this period. Around 1983, I initiated the Robinson Dry Storage Demonstration project and from then until 1989, I was

involved in the resolution of technical concerns regarding the performance of zircaloy clad fuel in dry storage. I was also a member of the Technical Management Oversight Committee for the dry storage project and participated in a number of technical meetings related to spent fuel issues.

5. In 1989, I transferred to the Emergency Preparedness and Spent Fuel Management unit of the Operations and Environmental Support Department where I was responsible for planning and coordinating the implementation of CP&L's spent fuel management program, which included both dry storage and shipment of spent fuel. In approximately 1992, my function and I transferred back to the Nuclear Fuel Section and, in 1998, to the Harris Nuclear Plant.

6. Since 1977, I have represented CP&L on numerous Nuclear Energy Institute and Electric Power Research Institute committees dealing with various aspects of nuclear fuel. In my current position as the Principal Engineer, Spent Fuel Management, I continue to be responsible for matters relating to spent nuclear fuel. I am also a Professional Engineer registered in North Carolina. My resume is provided in Attachment A to this affidavit.

7. The purposes of this affidavit are to provide facts, data and my opinion on which CP&L relies in evaluating the postulated occurrence of a zirconium self-sustaining exothermic oxidation reaction in Harris spent fuel pools C and D following a postulated loss of most or all pool water through evaporation (*i.e.*, "Step 7" in the seven step sequence of events identified on page 13 of the

Licensing Board's Order dated August 7, 2000 ("Order")) and to address the Board's second question concerning NUREG-1353. First, I describe the principles of a postulated self-sustaining exothermic oxidation reaction of zirconium spent fuel cladding. Second, I discuss the literature survey I conducted to research the likelihood of a self-sustaining exothermic oxidation reaction of zirconium spent fuel cladding occurring in the Harris spent fuel pools. Third, I describe the application of the information obtained in my literature survey to the spent fuel to be stored in Harris spent fuel pools C and D and the analyses I performed to establish that a self-sustaining exothermic oxidation reaction of zirconium spent fuel cladding is very unlikely in the Harris pools. Finally, I provide my conclusions on the unlikely occurrence of "Step 7" in the seven step sequence of events identified in the Board's Order.

PRINCIPLES OF THE EXOTHERMIC OXIDATION REACTION OF ZIRCONIUM SPENT FUEL CLADDING

8. Zircaloy, like most metals, undergoes an oxidation reaction in an air environment. This oxidation reaction is exothermic, meaning that the reaction releases heat. The oxidation rate, and, therefore, the rate at which heat is released, increases as the temperature of the zircaloy increases. At temperatures less than several hundred degrees Celsius, the exothermic oxidation reaction occurs very slowly.

9. The temperature of spent fuel zircaloy cladding is determined by the balance between the rate at which heat is generated in the fuel and the rate at which heat is transferred from the fuel. If the heat generation rate is greater than the rate at

which heat is transferred from the fuel, the temperature rises. If the generation rate is the same as the heat transfer rate, the temperature is constant, and the temperature decreases if the heat generation rate is less than the heat transfer rate.

10. The primary contributor to the heat generation rate in spent fuel is radioactive decay of material in the fuel, referred to as decay heat. The heat input from the spent fuel, also known as spent fuel decay heat, is primarily a function of the combination of the reactor power level, the burnup of the spent fuel, in megawatt-days per metric ton of fuel (MwD/Mtu), and the age (or "decay time") of the fuel. The decay heat rate drops drastically with time after the fuel is discharged from the reactor. Approximately five years after discharge from the reactor, the decay heat rate of the old, cold spent fuel is a small fraction of the decay heat rate of the same fuel when it was first stored in the spent fuel pools.

11. It is possible that in some conditions of very high cladding temperatures, the oxidation rate and the corresponding heat generation from the exothermic reaction can become a significant heat source, which, when added to the decay heat from the fuel, can contribute to a further increase in temperature. If the increase in heat generation rate due to the exothermic oxidation reaction exceeds the heat transfer from the fuel, temperatures continue to increase, causing further increase in oxidation reaction rate. This condition is referred to as self-sustaining exothermic oxidation, and is the focus of step 7. The clad temperature at which the self-sustaining oxidation reaction occurs is referred to as the critical cladding

oxidation temperature. The result of a self-sustaining oxidation reaction is likely to be loss of clad integrity and loss of fuel pellet containment in the fuel assemblies.

12. Spent fuel cladding below the critical cladding oxidation temperature continues to oxidize, but a protective oxide layer forms on the cladding and slows down the oxidation rate. The oxidation reaction proceeds at such a slow rate that more than sufficient time is available to reestablish cooling of the spent fuel before cladding damage resulting in exposure of spent fuel could occur.

13. The mechanisms for heat transfer from spent fuel are conduction, convection, and radiative heat transfer. Conduction and convection dominate heat transfer until clad temperatures reach several hundred degrees Celsius. Some early analyses assumed spent fuel pools were completely dry when calculating convection heat transfer, but later studies included sufficient detail to model the temperatures with water above the bottom of the fuel racks, which obstruct the free flow of air into the bottom of the fuel assemblies.

RESULTS OF A SURVEY OF THE AVAILABLE LITERATURE

14. I performed a survey of the publicly available literature regarding the potential for the initiation and propagation of a self-sustaining exothermic oxidation reaction involving spent fuel cladding following the partial, or complete, loss of water from a spent fuel pool.

15. In conducting my literature survey, I searched a number of sources to identify

documents addressing a self-sustaining exothermic oxidation reaction in spent nuclear fuel. My literature survey identified as relevant a total of seventeen (17) documents, which are listed in Attachment B to this affidavit.

16. My literature survey did not identify any analysis that reported a zirconium cladding oxidation temperature any lower than 800°C. Numerous studies report that the critical cladding oxidation temperature of zirconium spent fuel cladding is about 900°C. While the Advisory Committee on Reactor Safeguards ("ACRS") has indicated that the presence of zirconium hydrides on spent fuel may lower the critical cladding oxidation temperature, I did not identify any analysis that indicated zirconium hydrides would lower the critical cladding oxidation temperature below 800°C. NUREG/CR-5597 shows the onset of rapid zircaloy oxidation at 1500°K (1227°C). A table of reported critical cladding oxidation temperatures and the associated reports is presented in Attachment C to this affidavit.

17. Actual spent fuel has been heated up in air to a temperature of approximately 800°C under controlled laboratory conditions (see, Attachment B, reference 7). No zirconium self-sustaining exothermic oxidation occurred even when the spent fuel was heated to approximately 800°C in an air environment. This experimental result is consistent with the analyses reporting 800°C as a conservative lower bound for the critical cladding oxidation temperature of zircaloy fuel cladding.

APPLICATION OF AVAILABLE INFORMATION TO THE HARRIS SPENT FUEL POOLS C AND D

18. The residual or decay heat in nuclear fuel assemblies decreases rapidly after the fuel assembly is discharged from the reactor. Such decay heat is often described on an assembly basis in terms of the number of kilowatts of thermal energy given off (*i.e.*, in units of kilowatts per assembly). It can also be expressed on a per metric ton basis. This is determined by dividing the assembly kilowatts by the metric tons of uranium in the assembly. This kilowatts per metric ton is also referred to as a "specific heat" and is often used to make comparisons between different fuel types which differ in physical size and amounts of uranium.

19. Zircaloy self-sustaining exothermic oxidation does not occur below a fuel clad temperature of 800^{0}C. This temperature will not be reached unless the specific heat is above some minimum value. For high burnup fuel stored in high density racks, the NRC has conservatively selected, in its "Technical Study on Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants" (Attachment B, reference 5), three (3) kilowatts per metric ton as this minimum value. This value was previously six (6) kilowatts per metric ton for lower burnup fuel stored in more widely spaced storage racks.

20. Harris spent fuel pools C and D will only store spent fuel aged five years or more out of the reactor. It is anticipated that all spent fuel shipped in the future from Brunswick and Robinson to Harris will be stored in spent fuel pools C and D.

21. Spent fuel from the Brunswick and Robinson plants that is to be stored in Harris

spent fuel pools C and D is transported to Harris in CP&L's transportation cask. The existing transportation cask has strict heat load limits on the spent fuel that can be transported in the cask. The transportation cask Certificate of Compliance 9001 limits the maximum heat load of spent fuel shipped in the cask to a peak of 5,725 Btu/hr/PWR and 2,225 Btu/Hr/BWR which is equivalent to 3.7 Kw/Mtu for PWR fuel and 3.6 Kw/Mtu for BWR fuel. As a practical matter, these limits have not been approached and the peak assembly heat load of spent fuel transported to Harris spent fuel pools A and B was 2.5 Kw/Mtu for PWR fuel and 2.9 Kw/Mtu for BWR fuel. The peak assembly specific heats, at the time of shipment, for the shipments made to Harris pools A and B are shown in Figures 1 and 2 for PWR and BWR fuel respectively (Attachments D and E).

22. Figure 3 shows the decreasing specific heat curves for the PWR fuel stored in Harris spent fuel pools A and B (Attachment F). Some of this spent fuel will be moved to pools C or D in the future to make room for spent fuel discharges from the Harris reactor. Present projections show that the Robinson spent fuel will be 15 to 20 years old at the time it is moved to pools C or D. Due to its age, this spent fuel does not have a high enough specific heat to cause a self-sustaining exothermic oxidation reaction in pools C or D.

23. Figure 4 shows the decreasing specific heat curves for the BWR spent fuel stored in Harris spent fuel pools A and B (Attachment G). There are no present plans to move this spent fuel to pools C or D. This fuel has already cooled between 6 and

23 years. Due to its age, this spent fuel will not have a high enough specific heat to cause a self-sustaining exothermic oxidation reaction in pool C or D.

24. Figure 4 also applies to BWR fuel assemblies to be shipped from the Brunswick plant and then unloaded at Harris and stored in pools C or D. Since such fuel will have at least 5 years of cooling prior to shipment, this fuel will also not have a high enough specific heat to cause a self-sustaining exothermic oxidation reaction in pool C or D.

25. Figure 5 shows the decreasing specific heat curves for the high burnup Harris PWR fuel (Attachment H). Some Harris fuel with burnups over 40,000 MwD/Mtu was added to Harris spent fuel pools A and B beginning in 1991. Such spent fuel is not presently projected to be moved to pools C or D until 2011 or later; hence, such spent fuel will have cooled about 20 years. Due to its age, this spent fuel will not have a high enough specific heat to cause a self-sustaining exothermic oxidation reaction in pools C or D.

26. Anecdotal evidence exists that shows that zircaloy self-sustaining exothermic oxidation does not occur for cooled spent nuclear fuel. Between late 1977 and early 1981, CP&L shipped 290 PWR fuel assemblies from Robinson to Brunswick in over 40 shipments using air coolant in the shipping cask. At the time of shipment, this fuel had cooled between 2.7 and 6.5 years. There is no evidence that there was anything unusual about these assemblies when they were unloaded after receipt at Brunswick.

27. As shown in Figure 6, the amount of Ruthenium-106 decreases rapidly after the spent fuel assembly is removed from the reactor (Attachment I). This is because Ruthenium-106 has a half life of approximately one year; hence, half of the Ruthenium decays away every year. Only fuel aged for five years or more will be placed in pools C and D. By the time that pool C is filled, the average age of the fuel will be 23 years for PWR fuel and 10 years for BWR fuel. By the end of the Harris operating license (*i.e.*, 2026), the average age of the fuel in pool D will be 23 years for PWR fuel. No BWR fuel is planned to be stored in pool D. In 2026, the average age of the fuel in pool C will be 30 years for the PWR fuel and 22 years for BWR fuel. Thus, any evaluation of the amount of Ruthenium in pools C and D is not particularly meaningful.

28. Even if a small number of spent fuel assemblies in Harris spent fuel pools C and D could potentially sustain a zirconium self-sustaining exothermic oxidation reaction, it would be unlikely to propagate to adjacent assemblies because they have a heat load far too low to sustain a the reaction. Thus, even if a zirconium self-sustaining exothermic oxidation reaction could occur in Harris spent fuel pools C and D, its extent would likely be extremely limited because of the large quantity of extremely old, cold spent fuel stored in the pools and the small, if any, amount of undecayed Ruthenium remaining. Thus, it would appear that the consequences of a postulated zirconium exothermic oxidation reaction in spent fuel pools C and D would be bound by the consequences on the severe reactor

accident that initiated the scenario set forth in the Board's Order.

IMPACT OF RECENT DEVELOPMENTS ON NUREG-1353 ESTIMATES

29. I have reviewed the documents listed in Attachment J to this Affidavit to evaluate their impact on two estimates contained in NUREG-1353, "Regulatory Analysis for the Resolution of Generic Issue 82, 'Beyond Design Basis Accidents in Spent Fuel Pools'" (1989).

30. To the extent that any NUREG-1353 estimated value is applicable to the specific seven step scenario contained in the Board's Order, it is my opinion that the data or models that have been reported since the publication of NUREG-1353 do not suggest any substantive modification of those values. It is also my opinion, however, that, with the exception of the values associated with the probability of a self-sustaining exothermic oxidation reaction occurring in spent fuel following loss of spent fuel pool water level, the estimated values in NUREG-1353 do not appear applicable to the scenario postulated in the Order.

31. Regarding the probability of a self-sustaining exothermic oxidation reaction being greater than assumed in NUREG-1353, it is my opinion that this is clearly not the case for PWR spent fuel, as NUREG-1353 assumes a probability of 1.0 for this event. As to BWR spent fuel, I did not find in my literature search any basis for changing the probability value of 0.25.

CONCLUSIONS

32. As long as the heat output of spent fuel is less than the available heat removal

capability, the spent fuel will remain cool, and no self-sustaining zirconium exothermic oxidation reaction will occur.

33. For spent fuel with heat outputs less than the limits identified in the literature, no self-sustaining zirconium exothermic oxidation reaction will occur even if spent fuel pool water inventory is lost because the available energy is insufficient to initiate and sustain the reaction.

34. For spent fuel with a heat output above the identified limits, it is unclear whether a self-sustaining exothermic oxidation reaction will occur.

35. I conclude, therefore, that because of the low heat load in the old, cold spent fuel to be stored in Harris spent fuel pools C and D, it is highly unlikely that the spent fuel in pools C and D could sustain a zirconium self-sustaining exothermic oxidation reaction, even if most or all of the water in pools C and D is lost through evaporation.

36. I also conclude that in the highly unlikely event that a zirconium self-sustaining exothermic oxidation reaction were to occur in Harris spent fuel pools C and D, its extent would be extremely limited because most of the spent fuel to be stored in pools C and D will be far too old and cold to propagate the reaction. The consequences would certainly be bound by the consequences of the postulated degraded core accident with containment bypass that is the postulated initiator of the seven step sequence in the Board's Order.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 15, 2000.

Robert K. Kunita

Robert K. Kunita

Subscribed and sworn to before me
this 15 day of November, 2000.

Darlene S. Yarborough

My Commission expires: 2-21-2005

DARLENE S. YARBOROUGH
NOTARY
***
PUBLIC
HARNETT COUNTY, NC

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Work (919) 362-3132

Robert K. Kunita

Professional Experience

1973 - Present Carolina Power & Light Company

Principal Engineer – Spent Fuel Management

During my 27 years with Carolina Power & Light, I have worked in the Power Plant Engineering Section, the Nuclear Fuel Section, and the Emergency Preparedness & Spent Fuel Management Sections, all of which were in the Corporate Offices in Raleigh, NC. I have worked for the past two years at the Harris Nuclear Plant located in New Hill, NC in the Spent Fuel Management Subunit of the Environmental and Radiation Control Unit.

My experience covers a broad range of nuclear fuel related items from reactor systems interfaces, fuel design, fuel fabrication, nuclear material accountability, and spent fuel management. I was responsible for and accomplished reviews of system designs and NRC license application submittals, development and implementation of nuclear fuel fabrication surveillance plans, establishment and maintenance of a nuclear material accountability program, development of a dry spent fuel storage demonstration project which was successfully implemented, preparation of implementation of spent fuel shipping emergency exercises, and development of a corporate spent fuel management plan.

I have reviewed documents from the NRC, NEI, EPRI, etc. for technical adequacy and impact on CP&L and I have represented CP&L on numerous NEI and EPRI spent fuel committees.

1966 - 1973 Bettis Atomic Power Laboratory West Mifflin, PA

Associate Engineer through Senior Engineer

I worked for 7 years at the Bettis Atomic Power Laboratories, which was run by Westinghouse for the Naval Reactors Program. I was a member of the nuclear core design team for Admiral Rickover's Light Water Breeder Reactor Project, which subsequently ran successfully at the Shippingport Reactor. I performed computerized nuclear design calculations and participated in fuel design changes to optimize breeding while safely generating reactor power.

Education

Carnegie Mellon University Pittsburgh, PA

- 1973 M. S. Nuclear Science and Engineering

Illinois Institute of Technology Chicago, IL

- 1966 B.S. Physics

Registration	Registered Professional Engineer ▪ North Carolina, PE #007015
Awards	1993 CP&L Quality Achievement Award
Professional Memberships	American Nuclear Society Eastern Carolinas Section of the American Nuclear Society, past membership chairman and treasurer.

Attachment B

References

1. N. A. Pisano, F. Best, A. S. Benjamin and K. T. Stalker, "The Potential for Propagation of a Self-Sustaining Zirconium Oxidation Following Loss of Water in a Spent Fuel Storage Pool", Draft Report, January, 1984.

2. A. S. Benjamin, D. J. McCloskey, D. A. Powers, and S. A. Dupree, "Spent Fuel Heatup Following Loss of Water During Storage", NUREG/CR-0649, March, 1979.

3. V. L. Sailor, K. R. Perkins, J. R. Weeks, and H. R. Connell, "Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82", NUREG/CR-4982, July, 1987.

4. R. J. Travis, R. E. Davis, E. J. Grove, M. A. Azarm, "A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants", NUREG/CR-6451, August, 1997.

5. D. Jackson, T. Eaton, G. Hubbard, "Technical Study of Spent Fuel Pool Accidents for Decommissioning Plants", Draft, February, 2000.

6. A. B. Johnson, Jr., J. C. Dobbins, F. R. Zaloudek, E. R. Gilbert, and I. S. Levy, "Assessment of the Integrity of Spent Fuel Assemblies Used in Dry Storage Demonstrations at the Nevada Test Site", PNL-6207, July, 1987.

7. D. Stahl, M. P. Landow, R. J. Burian, and V. Pasupathi, "Spent Fuel Behavior Under Abnormal Thermal Transients During Dry Storage", PNL-5456, January, 1986.

8. C. Tinkler, Presentation to the ACRS Reactor Fuels Subcommittee, October 18, 2000.

9. E. D. Throm, "Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools"", NUREG-1353, April, 1989.

10. W. D. Travers memo to The Commissioners, "Improving Decommissioning Regulations for Nuclear Power Plants", SECY-99-168, June 30, 1999.

11. C. F. Boyd, "Predictions of Spent Fuel Heatup After a Complete Loss of Spent Fuel Pool Coolant", NUREG-1726, July, 2000.

12. L. Matus, L. Maroti, P. Windbert, M. Horvath, I. Nagy, A. Grigger, M. Balasko, "Post-Test Examination of the CODEX-AIT-2 Bundle", OPSA Final Report, Budapest, June, 1999

13. H. Ocken, "An Improved Evaluation Model for Zircaloy Oxidation", Nuclear Technology, Volume 47, February, 1980.

14. A. W. Cronenberg, "In-Vessel Zircaloy Oxidation/Hydrogen Generation Behavior During Severe Accidents," NUREG/CR-5597, September, 1990.

15. E.T. Burns, D. E. True, V. M. Andersen, "A Review of Draft NRC Staff Report: DRAFT Technical Study of Spent Fuel Pool Accidents for Decommissioning Plants", August, 1999

16. D.A. Powers, "Draft Final Technical Study of Spent Fuel Pool Accidents Risk at Decommissioning Nuclear Power Plants", letter to R. A. Meserve (NRC), April 13, 2000.

17. D. A. Powers, "Proposed Resolution of Generic Safety Issue-173A, 'Spent Fuel Storage Pool For Operating Facilities'", letter to R. A. Meserve (NRC), June 20, 2000.

Attachment C

Table of Reported Zircaloy Temperatures

Temperature	Reference (Attach B)	Description	Comment
1500^0K (1227^0C)	14, page 6-9	"Start of rapid zircaloy oxidation by H_2O uncontrolled temperature escalation"	
Around 900^0 C.	2, page 47	"The temperature at which clad oxidation becomes self-sustaining is a function of the storage configuration, but tends to occur around 900^0 C."	
About 900^0 C.	3, page 50.	"If the decay heat level is sufficient to heat the rods to about 900^0 C (1650^0 F) the oxidation becomes self-sustaining. That is, the exothermic oxidation reaction provides sufficient energy to match the decay heat contribution and the temperature rises rapidly."	
565^0 C	4, page 3-4	'The Workshop on Transportation Accident Scenarios estimated incipient clad failure at 565^0 C with expected failure at 671^0 C. presumably based on expert opinion. Given that the large seismic event is the dominant contributor to the configuration 1 initiator, it is likely that it would take a prolonged period of time to retrieve the fuel, repair the spent fuel pool or establish an alternate means of long-term spent fuel storage. Therefore, we presume there will be a significant period of time that the fuel will be exposed to air. On this basis, BNL has chosen a temperature of 565^0 C as the critical cladding temperature."	Incipient clad failure is not the onset of self-sustaining zirc reaction; it is the onset of clad swelling.
800^0 C	5, page A1-1	"The onset of rapid oxidation may occur as low as 800^0 C.	References 3.
About 900^0 C	9, page ES-1	If the decay heat level is high enough to heat the fuel rod cladding to about 900^0 C (1650^0 F) the oxidation becomes self-sustaining, resulting in Zircaloy cladding fire. Propagation of the Zircaloy cladding fire to	

		older adjacent assemblies is likely if the decay heat level in an older adjacent assembly is high enough to heat that assembly to within 100 to 200^0 C (200 to 400^0 F) of the self-sustaining oxidation temperature. Although propagation of a Zircaloy cladding fire to one or two year old fuel by only thermal radiation can occur, the older fuel would have to be next to the hottest assembly."	
800^0 C	10, page 4	"The working group is reviewing the temperature criteria used in the spent fuel analysis and the preliminary results indicate that a maximum allowable temperature of 800^0 C may be acceptable if certain analysis conditions are met. The conditions for applying this criteria would include demonstrating that the maximum calculated temperature, including uncertainties, remained below the temperature limit, that higher temperature effects are accounted for, and that a release of the radionuclides in the gap between the clad and the fuel is not a concern. The 800^0 C temperature limit is based on the lowest temperature for the onset of self-sustaining zirconium oxidation identified by the GSI 82 studies."…	
1600^0 F (871^0 C)	13, page 354	"It was concluded that a new evaluation model for Zircaloy oxidation should be applicable above 1144^0 K (1600^0 F), which is the temperature at which the Zircaloy oxidation rate becomes appreciable." "Measurements of the oxidation kinetics from prefilmed cladding and from specimens subjected to anisothermal conditions permit one to obtain some measure of the margin associated with different representations of the Zircaloy oxidation kinetics. The evidence shows that the presence of a prefilm significantly inhibits subsequent oxidation." [Prefilm is preoxidation or anomalous oxidation, see page 350].	This report references instances where zircaloy was oxidized at 927 ^{0}C, 1316^0 C, 1038^0 C, 1000 to 1690^0 C, 1300 to 1750^0 C. There is no mention of exothermic oxidation.

Figure 1 - Assembly Maximum Specific Heat (Shipments from Robinson)

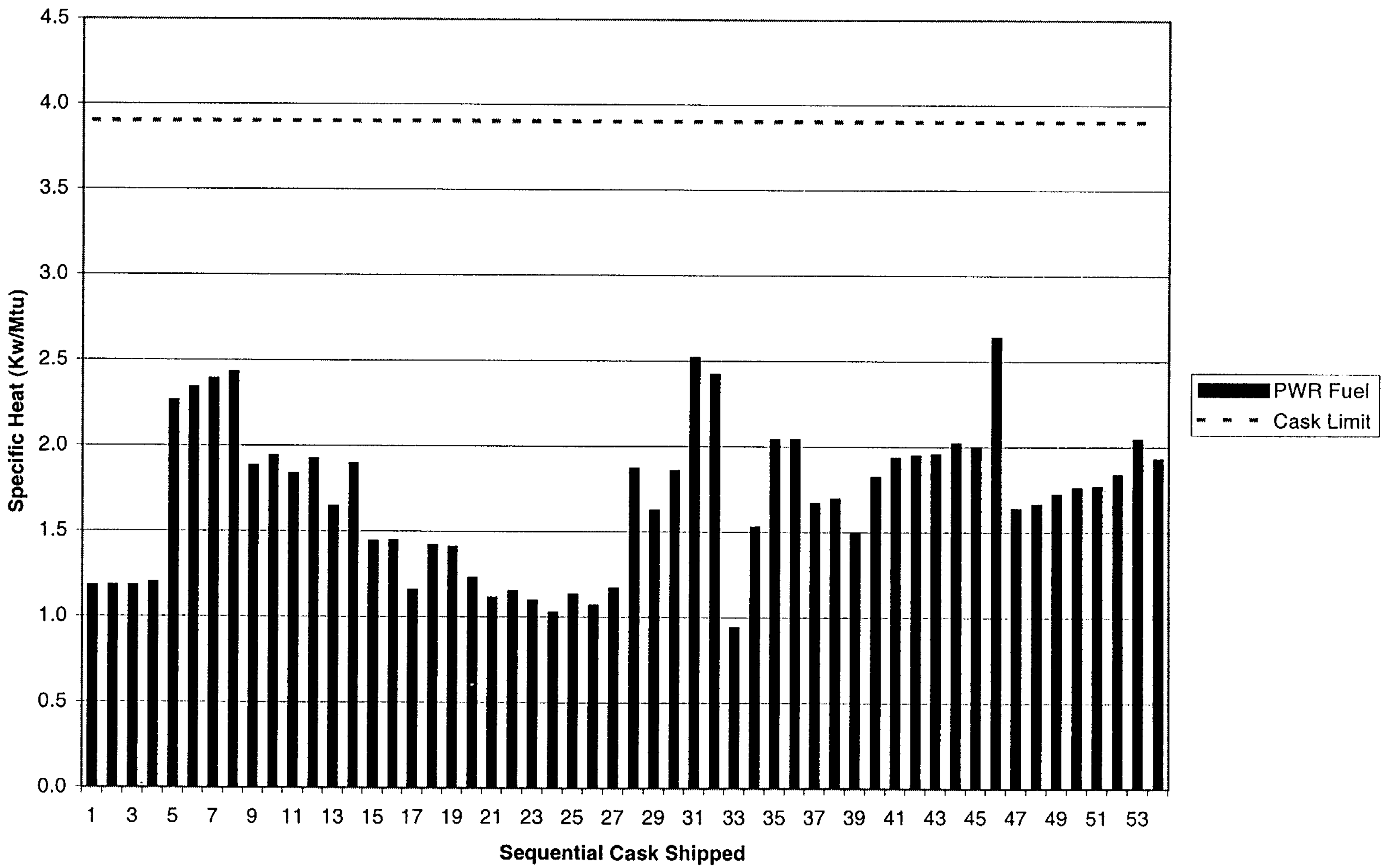
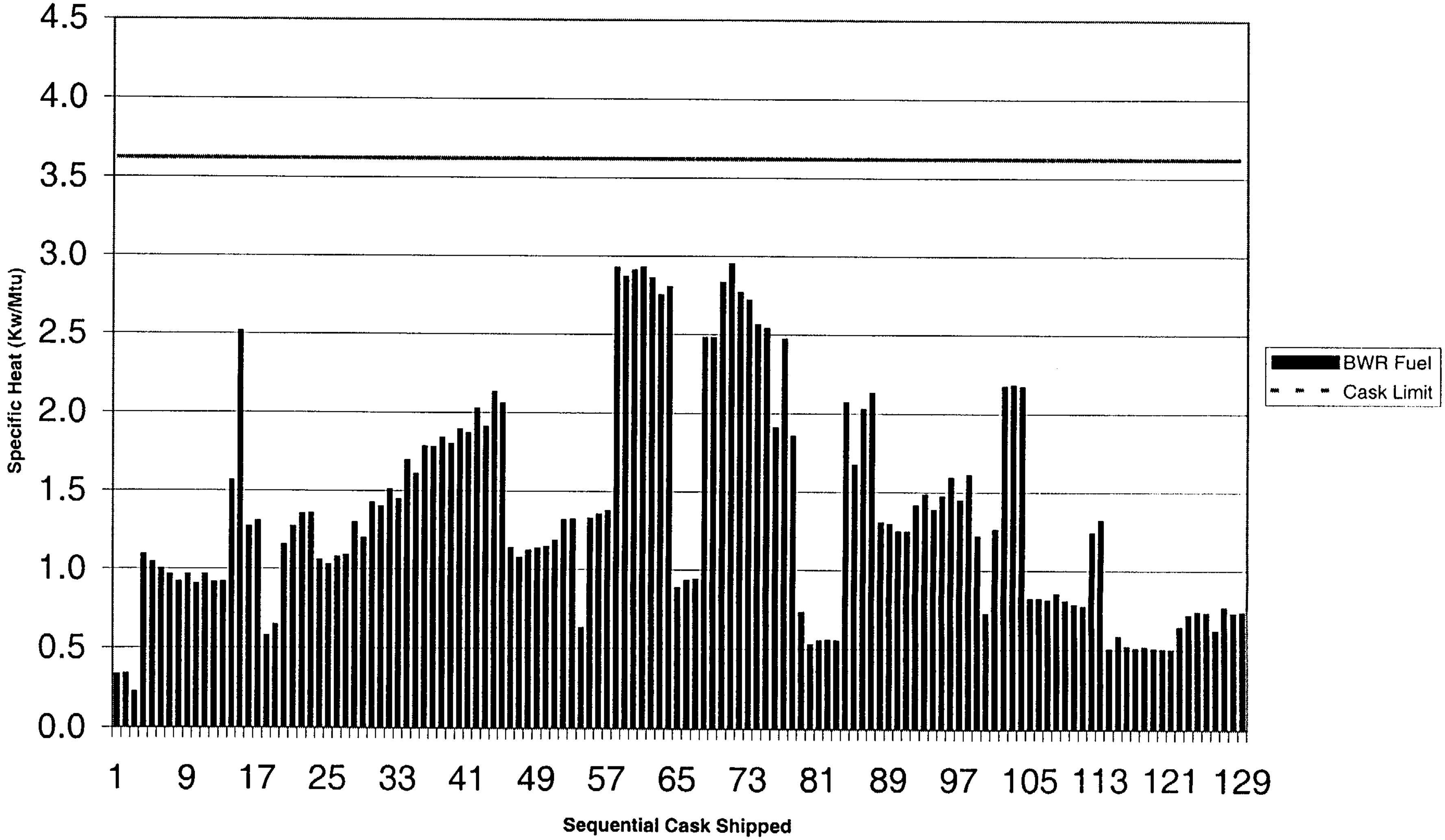


Figure 2 - Assembly Maximum Specific Heat
(Shipments from Brunswick)



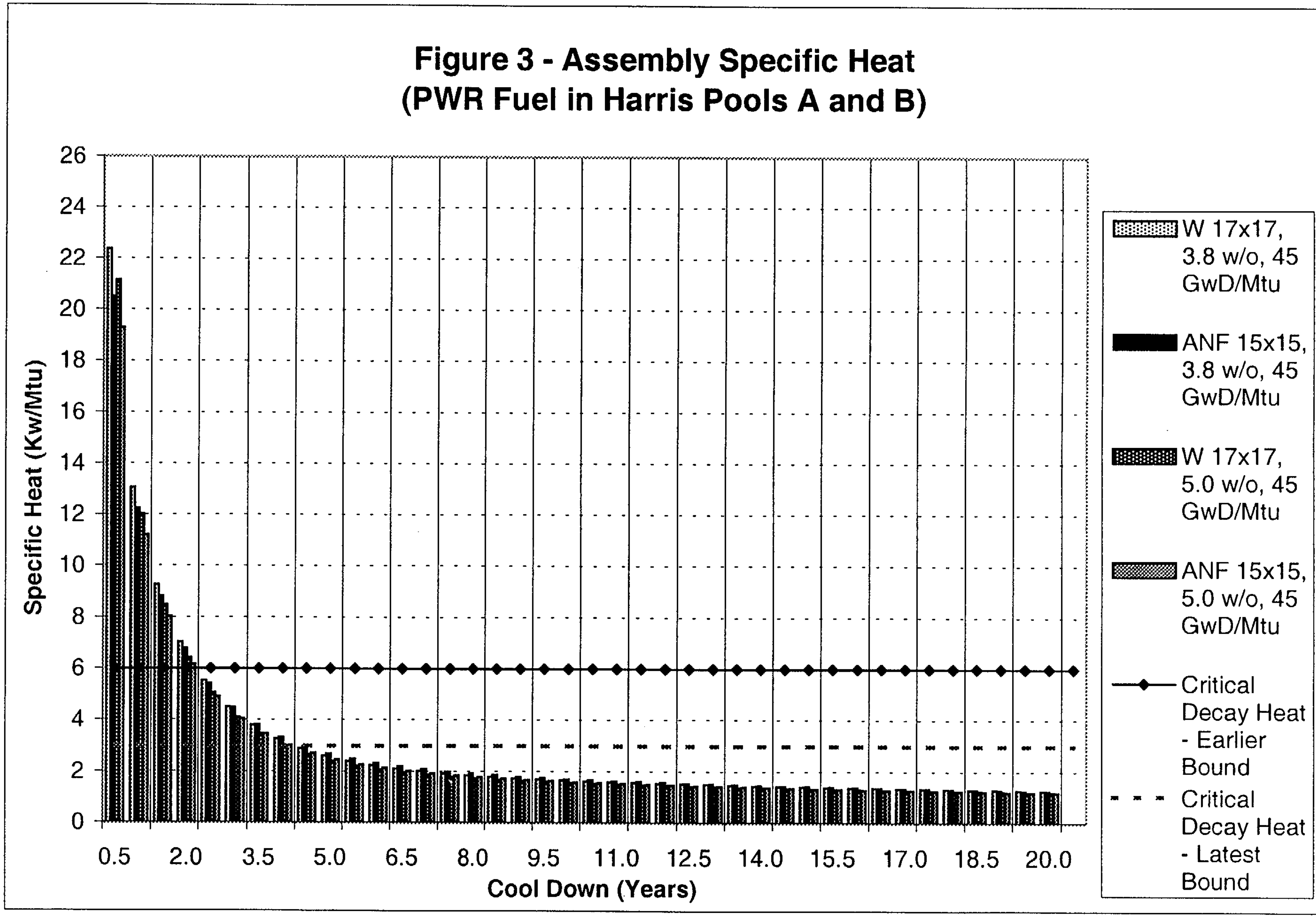
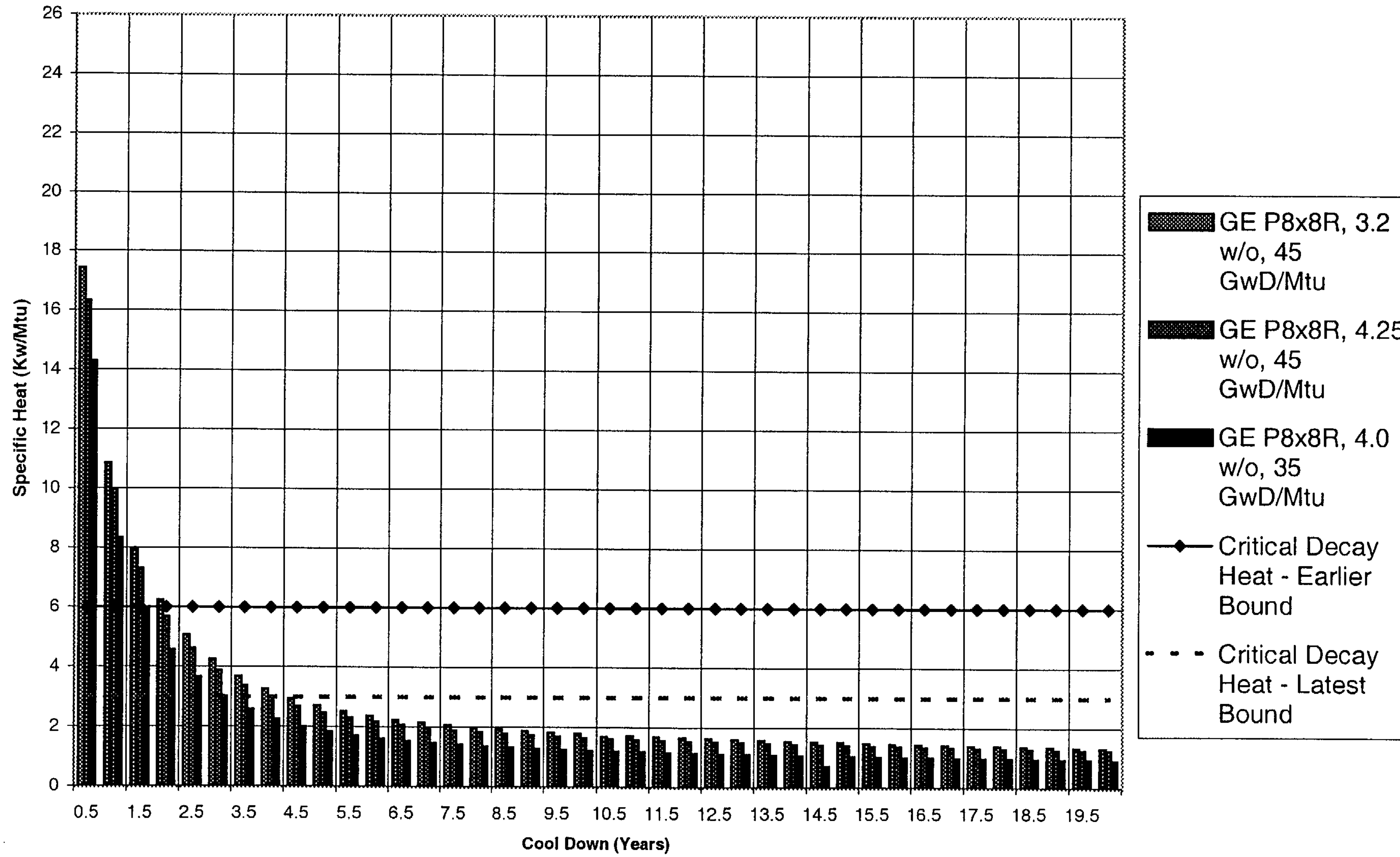


Figure 3 - Assembly Specific Heat
(PWR Fuel in Harris Pools A and B)
Specific Heat (Kw/Mtu)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0.5
2.0
3.5
5.0
6.5
8.0
9.5
11.0
12.5
14.0
15.5
17.0
18.5
20.0
Cool Down (Years)
W 17x17, 3.8 w/o, 45 GwD/Mtu
ANF 15x15, 3.8 w/o, 45 GwD/Mtu
W 17x17, 5.0 w/o, 45 GwD/Mtu
ANF 15x15, 5.0 w/o, 45 GwD/Mtu
Critical Decay Heat - Earlier Bound
Critical Decay Heat - Latest Bound

Figure 4 - Assembly Specific Heat
(BWR Fuel in Harris Pools)



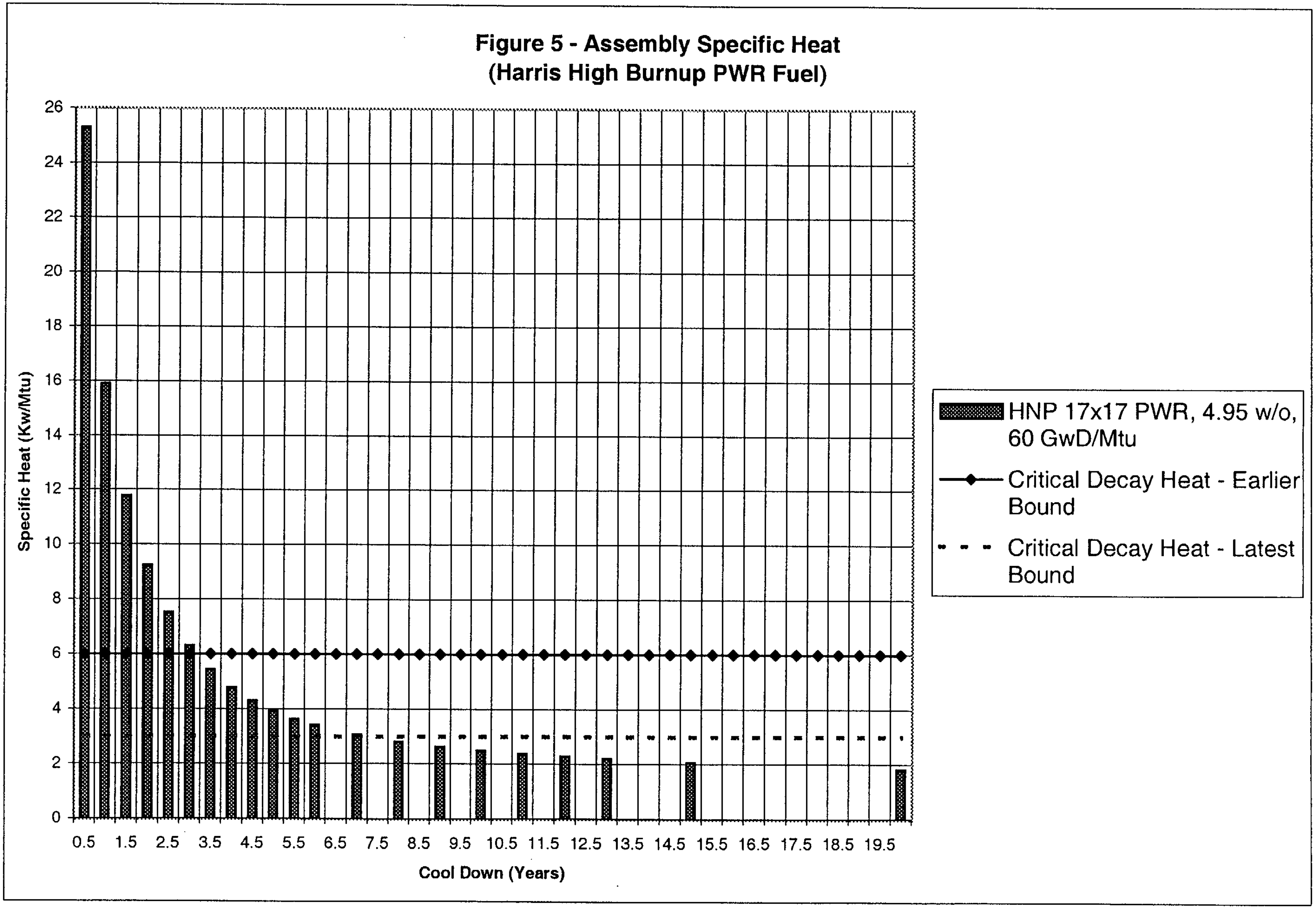


Figure 5 - Assembly Specific Heat
(Harris High Burnup PWR Fuel)
Specific Heat (Kw/Mtu)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
Cool Down (Years)
HNP 17x17 PWR, 4.95 w/o, 60 GwD/Mtu
Critical Decay Heat - Earlier Bound
Critical Decay Heat - Latest Bound

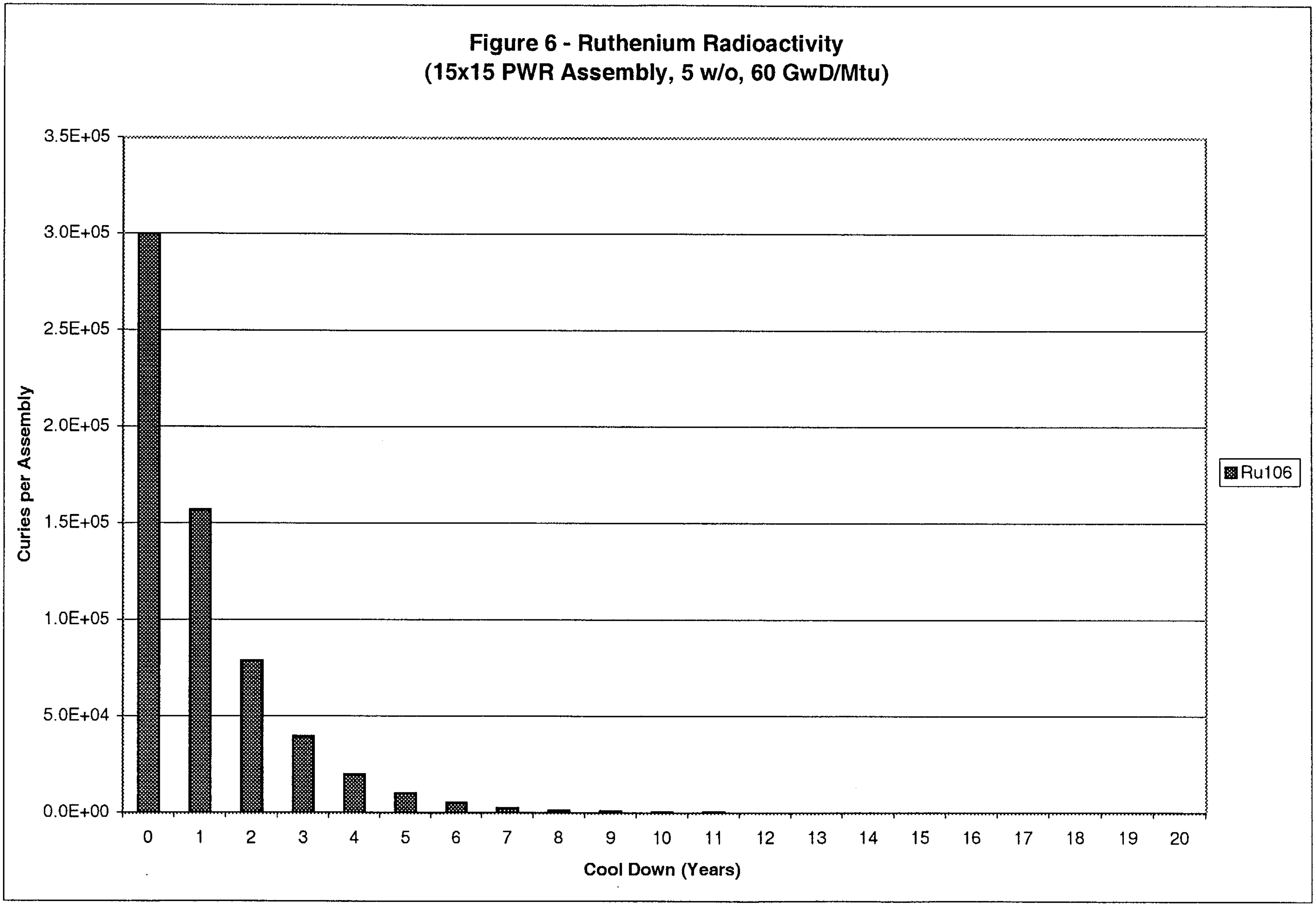


Figure 6 - Ruthenium Radioactivity
(15x15 PWR Assembly, 5 w/o, 60 GwD/Mtu)
Curies per Assembly
3.5E+05
3.0E+05
2.5E+05
2.0E+05
1.5E+05
1.0E+05
5.0E+04
0.0E+00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Cool Down (Years)
Ru106

Attachment J

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3. D.A. Lochbaum , ‘Comments on the Draft Susquehanna Safety Evaluation Regarding Spent Fuel Pool Cooling Issues, letter to Selin (NRC), November 29, 1994.

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19. D.A. Powers, "Draft Final Technical Study of Spent Fuel Pool Accidents Risk at Decommissioning Nuclear Power Plants", letter to R. A. Meserve (NRC), April 13, 2000.

EXHIBIT 3

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No. 50-400-LA
	)	
(Shearon Harris Nuclear Power Plant)	)	ASLBP No. 99-762-02-LA

AFFIDAVIT OF STEVEN A. LAUR

COUNTY OF WAKE	)	
	) ss:	
STATE OF NORTH CAROLINA	)	

I, Steven A. Laur, being sworn, do on oath depose and say:

1. I am a resident of the State of North Carolina. I am employed by Carolina Power & Light Company ("CP&L") and presently serve as Superintendent of the Probabilistic Safety Assessment Unit. This unit is responsible to update and maintain plant-specific risk assessment models in a quality manner; maintain consistency in selection and use of risk-based tools across the Nuclear Generation Group; and effectively use risk-based tools to achieve goals in the safety, production, cost and plant license renewal areas. I have as direct reports engineers located at the General Office and at the Brunswick, Harris and Robinson Nuclear Plants. My business address is 410 South Wilmington Street, Raleigh, NC, 27601.

2. I was graduated from University of Central Florida in 1972 with a Bachelor of Science in Mathematics and from Campbell University in 1985 with a Masters, Business Administration. Since receiving my Bachelor's degree, I have been employed by the United State's Navy, Ford Motor Company, RCA Service Company, Florida Power and Light Company, TENERA L.P., and CP&L. During my tenure at CP&L, specific positions held include Project Engineer in the Nuclear Licensing Section, Corporate Nuclear Safety Section, Risk Assessment Unit, and Probabilistic Safety Assessment Unit. I held a Senior Reactor Operator's license at St. Lucie Nuclear Plant, and have diverse technical and management experience in the areas of project engineering, plant operations, safety analysis, risk management, incident investigation and root cause determination. I am a registered Professional Engineer in the State of Florida. My resume is provided as Attachment A to this affidavit.

3. The purpose of this affidavit is to describe the information that was developed by CP&L for use by ERIN Engineering and Research, Inc. ("ERIN") for their performance of an analysis of the sequence of events set forth in the Atomic Safety and Licensing Board's Memorandum and Order dated August 7, 2000 ("Order"). First, I describe the review history of the documents that were used to develop the information. Second, I discuss the specific steps that were taken to ensure that the ERIN analysis was consistent with the plant-specific attributes that were important to the analysis. Finally, I present my conclusions on the quality of the ERIN analyses and the appropriate use of Harris-specific information.

4. My role in the preparing a response to the questions contained in the Board's Order was to provide the updated Harris Individual Plant Examination ("IPE") PSA model and the Harris Individual Plant Examination of External Events ("IPEEE") analysis to ERIN, which they used as the starting point for their analysis of the sequence of seven events set forth on page 13 of the Board's Order. Consistent with CP&L standards for configuration control, I ensured that Harris plant-specific PSA information was provided to ERIN as requested to support the analysis. I was also responsible for ensuring that the resulting ERIN analysis utilized correct and appropriate Harris plant information.

HISTORY OF THE HARRIS PROBABILISTIC SAFETY ASSESSMENT

5. The updated Harris IPE PSA model is a probabilistic safety assessment model that was originally developed for the Harris IPE pursuant to Generic Letter 88-20. The updated Harris IPE PSA model includes: 1) Event trees that model core damage accident sequences and containment response following a core damage event; 2) Fault trees that represent plant systems and failure modes; 3) Initiating event, component failure, and human reliability data; and 4) Special analyses, such as internal flooding and Interfacing System Loss of Coolant Accident ("ISLOCA"). The updated Harris IPE PSA model considers internal initiating events (except internal fires) and applies when the reactor is critical (Modes 1 and 2). The results of the updated Harris IPE PSA model include an estimated annualized core damage frequency. The Harris IPEEE analysis was performed pursuant to

Generic Letter 88-20 Supplement 4. The IPEEE considered 1) seismic risk, 2) internal fire risk, and 3) risk from other external events (e.g., high winds, tornadoes, and nearby facility accidents).

6. The updated Harris IPE PSA and the Harris IPEEE have been reviewed by organizations outside CP&L to ensure they possess a level of quality commensurate with their intended use. An Independent Peer Review of the model was commissioned. This review utilized industry standard guidance for review of PSA models (NEI 00-02, "Probabilistic Risk Assessment (PRA) Peer Review Process Guide") to determine the acceptability of the PSA model for use in analyzing the sequence of events proposed by the Board. ERIN, which was not involved in the development or update of the Harris updated IPE PSA model, performed the review, which is provided as Attachment B. This review provided high marks for the updated Harris IPE PSA model and concluded that, with one exception, the model formed an acceptable starting point for the sequence of events to be analyzed. This exception was the ISLOCA, which is important to the initiating event analysis of the Board's sequence of events, which ERIN determined to be overly conservative. Because the Board required a best-estimate analysis of the sequence of events, I directed ERIN to update the ISLOCA analysis to more realistically model that initiating event. Attachment C contains a table summarizing these reviews.

7. The CP&L management standard is that the Harris updated IPE PSA model be updated and maintained in a quality manner that is equivalent to applicable

portions of 10 C.F.R. Part 50, Appendix B. A CP&L Nuclear Generating Group Common ("NGGC") procedure controls the update and maintenance of the Harris updated IPE PSA model. This procedure requires that: 1) Software used to perform PSA applications and analyses must be qualified and controlled in accordance with NGGC procedures; 2) The PSA models and applications must be described and controlled in accordance with NGGC procedures; 3) PSA model changes, applications and analyses must be performed in accordance with NGGC procedures; and, 4) Errors identified in PSA models, PSA software, PSA methods, or PSA applications must be documented in the CP&L Corrective Action Program.

8. ERIN used the Harris updated IPE PSA and the Harris IPEEE analysis that I supplied as key inputs to their analysis of the Board's sequence of events. Use of these Harris models and analyses ensured that the ERIN analysis was based on the latest available, plant-specific risk information.

HARRIS SPECIFIC INFORMATION

9. To ensure that the ERIN analysis of the Board's sequence of events was consistent with the plant-specific attributes important to the analysis, I coordinated a review of the report by a multi-disciplinary team of individuals within CP&L who have knowledge and expertise in one or more of the areas covered by the report. This review included ensuring that the inputs provided by CP&L were correctly incorporated into the analysis. The review also validated that the methodology

used by ERIN was appropriate for use at Harris. The review confirmed that assumptions and statements made in the report concerning plant-specific features and characteristics were appropriate. I reviewed portions of the analysis and reviewed the comments provided by the other members of the CP&L review team.

10. When the Board's sequence of events was promulgated, I recommended an outside contractor be retained to perform the analysis and selected ERIN. I directed ERIN to provide a best-estimate risk assessment of the sequence of events described in the Board's Order and to report the result in terms of an estimate of the annual frequency of the entire scenario. This analysis was to include not only internal events as modeled in the Harris updated IPE PSA model, but also sensitivity analyses of the scenario frequency to other initiating events, including dominant internal fires and seismic events. The analysis was also to consider the sensitivity of the results to core damage events during shutdown conditions.

11. In order to support the analysis by ERIN, CP&L provided the plant-specific information specified in the table provided as Attachment D to this affidavit. Cognizant CP&L personnel reviewed each submittal to ERIN to ensure that accurate information was provided.

12. ERIN personnel toured the Harris facility on two occasions to gather plant-specific data for the analysis of the Board's sequence of events. ERIN personnel discussed pertinent plant information with cognizant Harris personnel, including

sources of make-up water to the spent fuel pools and accessibility of the reactor auxiliary building and fuel handling building during accident conditions.

CONCLUSION

13. In conclusion, the ERIN analysis of the sequence of events postulated in the Board's Order used appropriate Harris plant-specific information. The ERIN analysis utilized the information contained in, and builds upon, the existing Harris updated IPE PSA model and Harris IPEEE analysis, which are plant-specific studies. The Harris updated IPE PSA model was independently peer reviewed and found to be of high quality and appropriate for the analysis of the Board's sequence of events. The CP&L review of the ERIN analysis of the Board's sequence of events confirmed that the assumptions and data used by ERIN reflect the relevant attributes of the Harris plant.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 15, 2000.

Steven A. Laur

Subscribed and sworn to before me
this 15 day of November 2000.

Wanda C Langston

My Commission expires: 9-15-02

WANDA C. LANGSTON NOTARY *** PUBLIC WAKE COUNTY, N.C.

STEVEN A. LAUR, P.E.

Project Engineer

Professional Qualifications

Mr. Laur has over 20 years of engineering and managerial experience, which includes extensive experience in the operation, training, quality assurance, maintenance, and supervision of nuclear power reactors. He held a Senior Reactor Operator license at St. Lucie Nuclear Plant, and has diverse technical and management experience in the areas of project engineering, plant operations, safety analysis, risk management, incident investigation and root cause determination.

He has provided management consulting to assist nuclear plants in determining the root causes of and developing effective solutions to their performance problems. Additionally, Mr. Laur conducted performance-based assessments of nuclear utilities, with focus on operational readiness, independent oversight, quality verification, and regulatory compliance issues.

Mr. Laur was Project Engineer assigned to the Nuclear Licensing Section during the licensing process for Shearon Harris Nuclear Power Plant. He supervised four Senior Engineers and Specialists and seven Technical Aides, Licensing Assistants, and Production Assistants. He was the Harris Licensing Engineer during the ASLB hearings, receipt of the Final SER, and the ACRS sub-committee and full committee hearings for the plant. He served on the H. B. Robinson trip reduction team and conducted special investigations of plant events at all four CP&L nuclear units to determine root causes and assess the adequacy of corrective actions. He conducted internal assessments of CP&L's nuclear sites patterned after the NRC SALP program. Mr. Laur performed independent reviews as a member of the standing nuclear safety organization and provided insight to the organization, charter development, and startup phase of the CP&L Nuclear Assessment Department.

He is currently employed by Carolina Power & Light Company as the supervisor in charge of the Probabilistic Safety Assessment Unit, which is responsible for Risk analyses for the Brunswick, Harris, and Robinson nuclear plants.

Education/Special Training

MBA	Campbell University, 1985
B.S.	Mathematics, University of Central Florida, 1972

U.S. Navy Nuclear Power Training, Bainbridge, MD and West Milton, NY, 1975-1976

EG&G Accident Investigation Course, including Management Oversight and Risk Tree (MORT), 1987 (1 week)

TENERA Integrated Risk Management System training, October, 1994

Steven A. Laur

Experience

1998 - Present

Superintendent – PSA Unit, Carolina Power & Light Company. First-line supervisory position in charge of Unit responsible to update and maintain plant-specific risk models in a quality manner (equivalent to applicable portions of the 10CFR50 Appendix B program); maintain consistency in selection and use of risk-based tools across NGG; and effectively use risk-based tools to achieve goals in the safety, production, cost and plant life extension areas. Position has as direct reports engineers located at the General Office and at Brunswick, Harris and Robinson sites.

1995 - 1998

Project Engineer, Carolina Power & Light Company. Currently provides PRA support to the Brunswick, Shearon Harris, and H. B. Robinson nuclear plants. This support includes model development and maintenance as well as applications of the PRA to facilitate managing the risks associated with nuclear power operations. Familiar with current PRA methods and practices, including fault tree and event tree analysis, data gathering and analysis, human reliability analysis, and quantification of PRA models using the CAFTA computer code. Performed specialized PRA application studies to determine critical components for maintenance, to determine the risk associated with online maintenance activities, and to provide justification for technical specification changes.

Performed special fault tree model of the Harris emergency diesel generator control system to identify critical components for predictive and preventive maintenance to ensure continued high reliability. Greatly enhanced the quantification methodology for the H. B. Robinson PRA, with the result that the level 1 (core damage) model quantification time was reduced from over 24 hours to around 15 minutes. Provided analyses to evaluate the risk associated with several events at the Brunswick plant. Provided statistical analysis of increased control rod scram times for Brunswick unit 1.

1992 - 1995

Senior Consultant, TENERA, L.P. Provided management consulting to assist nuclear plants in determining the root causes of and developing effective solutions to their performance problems.

From December, 1991 through June, 1993, performed the human reliability analysis (HRA) for the Dresden and Quad Cities Stations as part of the Commonwealth Edison Company's Individual Plant Examination (IPE). Utilized the NUREG/CR-1278 (THERP) methodology. Observed licensed operators perform simulator exercises for Dresden and Quad Cities in support of the HRA. Reviewed plant response (event) trees for Dresden and Quad Cities; developed a fault tree model of the contaminated condensate storage tank inventory control function for Quad Cities. Performed an internal review of the HRAs for the Monticello and Clinton PRA models.

He assisted the Palisades plant in preparing for an NRC Diagnostic Evaluation Team (DET) inspection. He facilitated the identification of performance improvement initiatives and facilitated validation workshops to ensure all major problems facing the station were identified. In a similar effort, he assisted the Quad Cities plant in improving their ability to operate the plant efficiently and effectively, including work on the station Management Plan, prioritization, ranking, and management of issues, setting management expectations for site safety culture, and providing guidance regarding how to respond to their NRC Diagnostic Evaluation Team inspection.

In an effort to assist Commonwealth in addressing the placement of the Zion and Dresden plants on the NRC watchlist, assigned the role of technical team leader for the root cause portion of a comprehensive evaluation program (May, 1992). As a follow-on effort, was again the technical team leader for the root cause evaluation of the performance of the Quad Cities station in preparation for and NRC Diagnostic Evaluation Team (DET) inspection (July, 1993).

In 1992, participated in a performance-based assessment of the PSE&G Quality Assurance/Nuclear Safety Review organization. During this project, interfaced with PSE&G site supervisory and management personnel. Conducted technical information-gathering interviews with site personnel at a variety of levels and reviewed a variety of documentation in support of this project including the products produced by the QA/NSR organization, LERs, incident reports, QA reports, INPO evaluation reports, and NRC correspondence. Primary author of the resultant report to the client.

As a direct result of the 1992 assessment, awarded sole-source project to perform follow-on work for the PSE&G Nuclear Safety Review group.

In February, 1993, taught five one-day classes on the subject of NRC reporting requirements at both the PG&E corporate offices in San Francisco and at the Diablo Canyon nuclear plant. In a separate effort for PG&E, developed a technical basis document to support sampling plans for samples from a finite population without replacement (based on the hypergeometric distribution). Derived algorithm and developed corresponding computer code to aid in the calculation of the cumulative hypergeometric distribution.

1983 - 1991 Carolina Power and Light Company:

1991 *Project Engineer*, Risk Assessment Unit. Provided analysis and evaluation of nuclear power plant design features utilizing PRA techniques, including work necessary to respond to the NRC IPE requirements and severe accident policy. Provided human reliability analyses to support plant-specific probabilistic risk assessments. Utilized fault tree models and core damage sequences to provide comparative analyses of options for management decision making regarding modifications, justifications for continued operation, and requests for NRC waiver of compliance issues.

Developed fault trees to support a Brunswick plant application: Comparison of various proposed changes to the onsite electric supply and distribution system. Quantified the existing Brunswick PRA model using CAFTA computer code to determine the core damage frequency impact for the above application. Reviewed fault trees and event trees for the H. B. Robinson plant as part of performance of the human reliability analysis (HRA). Utilized the EPRI time reliability correlation, the EPRI decision tree, the NUREG/CR-1278 (THERP), and the NUREG/CR-4772 (ASEP) methodologies. Observed licensed operators perform simulator exercises for Robinson and Brunswick.

Provided statistical expertise in the development of sampling plans at the Brunswick plant. Wrote a computer program and performed Monte-Carlo simulation of emergency diesel generator starts.

1985 - 1990 *Project Engineer*, Corporate Nuclear Safety Section. Provided independent review of plant safety analyses and documents to assure proper maintenance of nuclear safety; developed recommendations for improvements in nuclear safety; assured proper corrective action taken to prevent recurrence of events involving nuclear safety; and conducted special evaluations of selected safety-related matters.

1983 - 1984 *Project Engineer*, Nuclear Licensing Section. Supervised up to 11 engineers and technicians within Licensing and functioned as first line management for projects and programs under his cognizance. Responsible for development and implementation of a computerized system for centrally tracking the company's regulatory commitments.

1981 - 1982 *Technical Staff Engineer*, Florida Power and Light Company St. Lucie Plant. Acted as licensing coordinator between the plant departments and the general office. Responsible for performing Technical Specification Surveillance Testing and for secondary plant performance testing and evaluation. Successfully completed training programs covering plant systems with emphasis on mitigating core damage in the event of a nuclear accident; qualified to stand watch as needed in the capacity of Shift Technical Advisor. Received Senior Reactor Operator license from the NRC.

1979 - 1981 *Project Engineer/Trial Coordinator*, RCA Service Company. Supported submarine acoustic trials at the Atlantic Undersea Test and Evaluation Center.

1978 - 1979 *Design Engineer*, Ford Motor Company. Engineer in the C-4 automatic transmission design unit.

1974 - 1978 *Nuclear Submarine Service*, U.S. Navy. Served in various engineering assignments aboard a nuclear submarine.

Special Qualifications

Registered Professional Engineer
Senior Reactor Operator License, St. Lucie Nuclear Plant
Nuclear Submarine Engineering Officer of the Watch

Professional Affiliations

Member of the American Nuclear Society (ANS)
Member of the Institute of Electrical and Electronics Engineers (IEEE)

PEER REVIEW OF SHEARON HARRIS PSA

Prepared for:

Carolina Power and Light Company

Prepared by:

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November 7, 2000
Final Report

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SECTION 1
INTRODUCTION

1.1 SCOPE

The purpose of this report is to document the results of an independent review of the Shearon Harris PSA ("Harris PSA") that was performed in October 2000 by ERIN Engineering and Research, Inc. under contract with Carolina Power and Light Co. The purpose of the review is to support the use of the Harris PSA in an evaluation of scenarios that could cause or exacerbate a loss of cooling to the spent fuel pool at the Harris plant. The objectives of the review are to assess the quality, scope, and technical adequacy of the existing PSA models to support PSA applications and specifically the evaluation of postulated spent fuel pool scenarios. In addition, the peer review determines what enhancements to the PSA models are desirable to complete the spent fuel pool evaluation.

The scope of the peer review was limited to a documentation review. No onsite visit or direct interaction with the PSA was performed as part of this peer review.

1.2 REVIEW APPROACH

The approach to conducting the review is based on a PSA peer review process that was originally developed by the Boiling Water Reactor Owners Group and is now being used by all of the existing LWR owners groups, including the WOG (Reference [1]).

The purpose of this report is to document a peer review of the Harris PSA using the methodology and checklists developed for WOG peer reviews in order to support the application to the spent fuel pool evaluation.

The PSA Peer Review Process described in Reference [1] provides a structured process to review a PSA using a checklist that examines the PSA in terms of 11 elements and 209 sub-elements. These PSA elements are listed in Table 1-1.

Table 1-1
PSA Elements

Element Code	PSA Element
IE	Initiating Events
AS	Accident Sequence Evaluation
TH	Thermal Hydraulic Analysis
SY	System Analysis
DA	Data Analysis
HR	Human Reliability Analysis
DE	Dependencies
ST	Structural Response
QU	Quantification
L2	Containment Performance
MU	Maintenance and Update Process

Each of the above elements is further broken down into a total of about 209 sub-elements to permit a structured and detailed examination of the PSA and its associated models and documentation.

A summary of the major review findings and recommendations for future updates is provided in Section 3.

1.3 REVIEW TEAM

A review team consisting of Karl Fleming, Tom Daniels, Jeff Gabor, Ed Burns, and Grant Tinsley carried out this review. Karl Fleming is a recognized expert in developing and applying PSA technology and in performance of PSA peer reviews. He served as the leader of the review team and was responsible for the review of about half of the PSA elements and for the preparation of this report. Ed Burns was the principal author of the PSA Peer Review process that was used in this report and has been involved in more than 25 peer reviews that have been completed using this methodology. Mr. Fleming and Dr. Burns are also principal authors of the ASME PRA standard (Reference [2]) which is currently under development to support the PSA review process. Mr. Daniels has extensive experience as a PSA practitioner and is also playing a lead role in modifying the existing Harris PSA models to support the evaluation requested by the Atomic Safety Licensing Board. Jeff Gabor is a recognized expert in PSA technology and was a principal author of the accident progression analysis methodology that was used in the Harris PSA to support success criteria, sequence timing and source term assessment. Grant Tinsley also has extensive experience as a PSA practitioner and has experience in applying the industry peer review process at several plants. As a team, this group is adequately qualified and experienced to reach technically sound conclusions about the technical quality of the PSA and its capability to support the spent fuel pool licensing evaluation.

As a final note, while a grading system is used to provide a reasonable degree of consistency in the peer review process, the most valuable result of this type of review is a focused set of strengths and weaknesses that the PSA group can use in existing applications. Hence, the grades themselves do not assure PSA quality, but rather the supporting strengths and weaknesses that are identified from the grading process provide a roadmap for steps that should be taken to implement quality PSA applications.

SECTION 2
REVIEW RESULTS FOR PSA ELEMENTS

The technical review was organized into the PSA elements listed in Table 1-1 so that the Industry PSA Peer Review Process could be closely followed. The results of the review for each element are provided in Sections 2.1 through 2.11 below.

2.1 IE - INITIATING EVENTS

The scope of this element includes identification and grouping of initiating events (IE) and the estimation of initiating event frequencies. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-1. The key points from this evaluation are summarized below:

- The extent of updating of the initiating events analysis and the use of formal calculations to document the in-house reviews provides good evidence that the initiating events analysis reflects the as-built and as-operated plant.
- The selection of an initiator to represent loss of normally running and standby charging pumps is unusual, but reflects thoughtful consideration of plant specific and unique features; this event leaves the plant with no high pressure makeup if the scenario should develop into a LOCA.
- The statistical methods used to estimate the initiating event frequencies include both classical (chi-squared) and Bayesian. In future updates all events should be quantified in a Bayesian framework for consistency, however this does not have an appreciable impact on the numerical results.
- The analysis of the frequency and recovery of loss of offsite power reflects the state of the art in the early 90's and would benefit from more recently collected and analyzed data such as those in Reference [3]. An updated analysis would likely show that the current analysis is somewhat conservative.

- The IE frequency analysis is well documented and is traceable to sources for generic and plant specific evidence, but the sources should be updated and a consistent Bayesian methodology should be used for all events.

- The steam and feed line break IE frequencies are well documented but based on somewhat old references and should be updated. An updated analysis would likely show that the current analysis is somewhat conservative.

- Some of the IE frequencies developed from failure rates are not weighted by a plant availability factor and are therefore biased on the high side by the inverse of the availability factor. An updated analysis could show that the current analysis is somewhat conservative by 20% to 30%.

- A check of the Bayes update calculations is included as part of the data evaluation in Section 2.5

- The report contains a very good discussion of how initiating events are binned based on functional categorization and binning trees.

- ISLOCA initiating frequency evaluation appears quite conservative compared with other similar plants. This could be reassessed to make the PSA more realistic. Specific comments on the ISLOCA models are included with the review of the Level 2 PSA element in Section 2.10.

The Harris PSA report text says that IE fault trees for certain systemic events such as service water were linked with mitigation fault trees. These initiating event fault trees were reviewed indicating a number of issues that are listed below.

- The fault tree models used for initiating event frequencies include combinations of two or more basic events with an annual exposure time. An example is a cutset at 3.1E-08 involving a Loss of Instrument Air initiator (%T13) that includes the basic events ACP1ANS%FN and ACP1BN%SFN representing the A and B compressors. Both of these basic events use the compressor failure rate times 8760 hours. Common cause failures of 2 and 3 compressors are included separately. The fault tree logic should be such that these combinations are not generated or the combinations can be included in the mutually exclusive file. The exposure time for the first failure is 8760 hours, but the exposure time for any subsequent failures is the repair time for the first component failed. Similar combinations exist in the Loss of Normal Service Water (%T9) and Loss of CCW (%T11) initiating event models.

- The fault tree model for the Loss of CCW initiating event does not include combinations of pump failure to run with a failure to reseat of the failed pump's discharge check valve. This is also true for the Loss of Normal Service Water (%T9) and Loss of Instrument Air (%T13) initiating events.

- The models for loss of a 6.9kV bus initiating event consist of a single basic event representing bus failure during operation multiplied by 8760 hours. The model should account for other failure modes, such as circuit breaker transfers open while indicating closed.

- The model for loss of non-safety DC bus DP-1A (%T15) consists of 2 basic events, one for battery short and one for distribution panel failure during operation. The model should account for other failure modes, such as battery charger failure during operation in combination with battery failure on demand, assuming the battery is sufficient to supply loads without the charger.

- The inclusion of "failure of NSW pump strainer to run" leading directly to Loss of Normal Service Water (%T9) may be overly conservative. It is a dominant contributor to the initiating event frequency.

- The fault tree logic correctly treats the dependencies associated with some of the same components and failure modes appearing in the initiating event frequency fault trees and the mitigation function fault trees by using different basic event names for each. Flags are used to make sure that equipment is not permitted to fail more than once.

- The initiating events quantified using fault trees as well as those quantified using data did not have an availability factor applied to account for the probability that the plant is in operation at the time of the event; this creates a conservative bias on the order of 10% to 20% in the initiating event frequencies.

- In the loss of charging system initiating event model, it is not clear that the correct times were used in modeling cutsets with valves transferred closed in combination with pump failures.

Table 2-1

Evaluation of Initiating Events Elements

Attribute	Assessment
Guidance	It is not known whether CP&L has any separate guidance documents but the PSA documentation of the initiating event analysis is very thorough and hence, serves as useful guidance to support PSA updates.
Grouping	The identification and grouping of initiating events was very thorough and comprehensive. Good use of insights from EPRI ATWS study and PSAs on other Westinghouse PWR plants. Event trees used for binning provide a very clear description of how each event was treated.
Treatment of Support System/Special Initiators	A systematic search for plant specific important initiators was performed in the system notebooks. The final list of initiating events includes a relatively large number of support system initiators which is appropriate for PWR plants. The only PSA in the country that has a larger list of initiating events is probably Calvert Cliffs, which is an industry outlier in this respect. The Harris PSA list appears to be as complete as other PSAs such as South Texas which are regarded as quality PSAs. A very good level of completeness could be brought to excellent if the list was expanded to consider common cause bus failures as initiating events (there have been a few events at other plants where degraded components inside switchgear cabinets have failed energetically , and other events in which fuses inside multiple inverters have blown taking out multiple buses at the same time. Another category of events are failures in multiple support systems that functionally interact, such as failure of a CCW train with a SW train supporting the opposite CCW train (some refer to the occurrence of initiating precursors). The ISLOCA frequency appears unrealistically high and may bias the results of the PSA in certain applications.
Data	One aspect of the initiating events analysis that has significant room for improvement. The initiating event frequency calculations were very clearly documented and traceable back to the source data, but several problems were noted. One is the inconsistent use of classical and bayesian statistical method. The other is the need to update the generic database as the NRC via INEEL has recently published some more up to date and more realistic sources. Such an update is expected to result in somewhat lower initiating event frequencies for some events.
Documentation	The documentation of the initiating events analysis is excellent and would likely get a grade level 4. The documentation is very clear and makes the analysis quite transparent. There is very good use of figures and tables and key data and assumptions are justified and the bases traceable back to the source.
Recommended Enhancements	Update the generic data inputs from the INEEL study and perform a consistent Bayes' update for all initiating events using the generic distributions from the INEEL study. Update the loss of offsite power frequency and time to repair distributions. Include the plant availability factor in all initiating event models.
Overall Process Assessment	The initiating events analysis is capable of supporting risk significance determinations with deterministic input. The current initiating events analysis would be peer reviewed at a solid Grade 3, and if the recommended enhancements were made with the same level of quality of other aspects of the analysis, this element would be at Grade 4.

Recommended Element Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ■ **Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input**
- ☐ Grade 4 - Provides Primary Basis For Application

2.2 AS – ACCIDENT SEQUENCE EVALUATION

The scope of this element includes identification and grouping of functional accident sequence categories, event tree development, core damage and plant damage state characterization and interface with other elements such as initiating event identification and systems dependency analysis. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-2. The key points from this evaluation are summarized below:

- Sequence definition is accomplished via event sequence diagrams and event trees that are very clearly documented
- Very thorough treatment of transient induced LOCAs via PORV and safety valve pressure challenges.
- Used NUREG-1150 RCP seal LOCA model; according to the Westinghouse Owners' Group, the assumption of a 1.5 hour time to begin leaking is now regarded as questionable for some of the RCP seal failure modes, especially the so-called popping failure mode. A more up to date model, such as the Rhodes model, should be considered for the next update.
- Good development of event tree logic from safety functions and clear presentation of success criteria.
- Transient ESD/ET does not credit alternate feedwater as indicated in the EOPs/FRGs for sequences in which there is failure of main feed, auxiliary feedwater, and feed and bleed.

- Figure 4-5 has no labels, just graphics. (not critical to the review)
- Table 4-6 presents pump capacities but not the pressures that corresponds to these capacities; it would also be helpful know the shutoff heads of these pumps.
- No credit taken for operators to terminate sprays results in a conservative treatment of RWST depletion time.
- The LOSP event tree does not discuss how RCP seal LOCAs are treated, nor does it describe how offsite power recovery is factored in. This needed to be determined from other documents. It is confusing that SBO sequences include both Auxiliary Feedwater System (AF) success and AF failed sequences. There must be logic in the recovery file that effectively creates different sequences. Certain sequences appear to be missing: Loss of offsite power, RCP seal LOCA starts, offsite power successfully restored, core damage due to failure to continue to provide makeup or other LOCA mitigation functions. This would be evidenced by transfers to the Small LOCA event tree if these conditions were met
- Bridge tree is judged to address all relevant plant damage state issues.

Table 2-2

Evaluation of Accident Sequences Element

Attribute	Assessment
Guidance	It is not known whether CP&L has any separate guidance documents but the PSA documentation of the accident sequence analysis is very thorough and hence, serves as useful guidance to support PSA updates.
Success Criteria and Bases	Success criteria tabulated for each event tree and is generally traceable back to the source calculation. A number of the success criteria are acknowledged to be conservative and lead to an overstatement of risk for some applications. However, the success criteria developed from the assumption that RCP seal LOCAs do not initiate for 1.5 hours alludes to an error in NUREG-1550 in how information provided by Westinghouse for the use in the expert elicitation was interpreted. Information from the WOG indicates that some RCP seal failure modes may occur almost immediatey. In addition, the WOG has indicated that if seal injection is lost for 10 minutes it should not be restarted to prevent a thermal shock induced seal failure.
Accident Scenario Evaluation (Event Tree Structure)	There was a good use of safety functions and event sequence diagrams to document sequence development. The event tree structures are simplified in relation to many other plants using the same methodology, but otherwise well documented. The LOSP event tree appears to be overly simplified; for example SBO sequences with successful and unsuccessful auxiliary feedwater are collapsed into the same sequence. It does not appear that LOSP sequences with RCP seal LOCAs and successful OSP recovery have been processed as SLOCA sequences, and this simplification is optimistic. This does not have a significant impact on the baseline CDF but could be a problem for certain applications in which changes to the ECCS system were being evaluated.
Interface with EOPs/AOPs	There are number of references to mitigation possibilities that are covered in the EOPs and FRGs to justify and develop the event trees, however in several of these cases the full mitigation addressed in the EOPs is not credited creating some conservatisms.
Sequence End State Definition/Treatment	The Level 1 end states are success and core damage; a Bridge Tree is used to interface with the Level 2 Containment Analysis through the definition of a set of plant damage states. The plant damage states track sufficient information to resolve dependencies between the Level 1 and Level 2 event sequence models. The Level 1 end state provides a clean interface with the Level 2 anlysis and is clearly described.
Documentation	The documentation is excellent making the event tree analysis and assumptions quite transparent.
Recommended Enhancements	A more up to date RCP seal LOCA model should be used, and for some applications it might be fruitful to eliminate some of the above noted conservatisms. The LOSP event tree should be expanded and the links to the Small LOCA tree for RCP seal LOCAs and successful OSP recovery created and/or identified.
Overall Process Assessment	When the recommended enhancements are incorporated this element of the PSA is of sufficient quality to support risk significant evaluations with deterministic input. However even without these enhancements, this aspect of the PSA is adequate to meet most applications.

Recommended Element Grade:
☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
☐ Grade 2 - Supports Risk Ranking Applications
© **Grade C3 - Supports Risk Significance Evaluations w/Deterministic Input(conditions)**
☐ Grade 4 - Provides Primary Basis For Application

2.3 TH – THERMAL HYDRAULIC ANALYSIS

The scope of this element includes the engineering and thermal hydraulic analysis that supports the PSA in several key areas including success criteria for the accident sequence model and systems analysis, time windows for HRA, room heatup analyses, and plant and containment analyses that support the Level 2 PSA. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-3.

Table 2-3

Evaluation of Thermal Hydraulics Element

Attribute	Assessment
Guidance	It is not known whether CP&L has any separate guidance documents but the PSA documentation of the thermal hydraulics analysis is very thorough and hence, serves as useful guidance to support PSA updates.
Best Estimate Calculations	The thermal hydraulics analysis supports the PSA success criteria, time windows for human operator actions, and analysis to support the Level 2. These analyses include simple mass and energy balances, plant specific MAAP analyses, and operator training simulator exercises for key accident sequences. In general, these analyses are realistic, technically sound, well documented and traceable to adequately support the PSA models and assumptions.
Room Heatup Calculations	Room heatup calculations were performed and appear to be realistic and yield reasonable results.
Documentation	This TH analysis is among the best documented for a PSA that the review team has seen. There are many figures and charts that display a deep understanding of the results and their limitations.
Recommendations for Enhancements	Maintain this quality level as the PSA experiences future updates.
Overall Process Assessment	This element of the PSA is a key strength and is capable of supporting the envisioned risk informed applications.

Recommended Element Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input
- ■ **Grade 4 - Provides Primary Basis For Application**

2.4 SY – SYSTEM ANALYSIS

The scope of this element includes the analysis of systems that support the PSA, including the identification of system functions addressed in the PSA, system success criteria, system dependencies, potential for causing an initiating event, fault tree models that support the accident sequence models, and probability models to support the accident sequence quantification. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-4.

Table 2-4

Evaluation of Systems Analysis Element

Attribute	Assessment
Guidance	It is not known whether CP&L has any separate guidance documents but the Systems Notebooks are very thorough and hence, serves as useful guidance to support PSA updates.
Systems Modeled	23 original systems notebooks and one additional system notebook (SFP cooling & cleanup) have been developed. All expected SSCs (i.e., PWR CDF contributors) modeled. "Extra" SSCs (above usual scope) observed including demin water, non-safety related SW and main FW (and SFP cooling & cleanup as previously mentioned).
System Model Structure (Fault Tree)	The fault tree models are extensive. They are consistant with or exceed industry practice in all aspects. Excellent system-to-system consistency in format, structure, and level of detail.
Success Criteria	Plant-specific T-H calcs for CVCS, AFW, RHR, ESW, MFW. Extensive, appropriate use of plant-specific MAAP model to support systems success criteria development.
Recommended Enhancements	More frequent system updates (last complete update was 1995). Consider more flexible, independent update for those SSCs undergoing significant modifications could be considered. This should be possible given the software either available or imminent (i.e., FORTE solution engine, etc.) and the move with the "2000" update to make all notebooks controlled engineering calculations.
Overall Process Assessment	Very difficult to find fault with even the 1995 notebooks; the few completed "2000" notebooks reviewed were even better. One of the very best examples of systems analysis and documentation this reviewer has seen in the industry, including those studies in which he has managed or participated. The system-to-system consistency is outstanding.

Recommended Element Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input
- ■ **Grade 4 - Provides Primary Basis For Application**

2.5 DA – DATA ANALYSIS

The scope of the evaluation for this element of the PSA includes development of component failure rates, maintenance unavailabilities, common cause parameters and miscellaneous data parameters that are needed to calculate the PSA basic event probabilities. The estimation of initiating event frequencies is covered in the initiating events analysis element.

The following items were identified as part of the data review.

- Plant specific data was only collected and analyzed for selected pumps, the diesel generators, and chillers. No justification was given for why plant specific data was not collected for other key components such as valves, breakers, etc. It would be preferable to use the risk importance measures to decide where plant specific data should be collected.

- A rather convoluted procedure was used to apply Bayes' updating to combine plant specific experience on the above mentioned components and generic uncertainty distributions. This procedure was used to take advantage of conjugate properties of certain contributions of assumed prior distributions and assumed likelihood functions. ERIN checked the Bayes' update with a more commonly used procedure where the prior distribution is assumed to be lognormal, the binomial likelihood function is used for demand based failure rates, and the Poisson distribution is used for time based failure rates. The ERIN analysis was performed using a proprietary software known as BART™ (Reference [3]). The results of this comparison are shown in Table 2-5 and show good agreement. CP&L should consider using the recommended procedure as discrepancies in the case of the diesel generator failure rate of approximately 10% could be significant under certain conditions.

Table 2-5

Comparison of Bayes' Updated Failure Rate Distributions

Component/ Failure Mode	Method[1]	Mean	50%Tile	95%Tile	Range Factor
Motor Driven AFW Pump Fail to start (UD-1)	Harris PSA	2.2E-3	1.9E-3	4.5E-3	2.4
	ERIN 1	2.0E-3	1.8E-3	4.1E-3	2.5
Motor Driven AFW Pump Fail to run (UD-2)	Harris PSA	2.6E-5	1.5E-5	8.2E-5	5.4
	ERIN 1	2.6E-5	1.5E-5	8.1E-5	5.3
Turbine Driven AFW Pump Fail to start (UD-3)	Harris PSA	1.2E-2	1.2E-2	1.5E-2	1.3
	ERIN 1	1.4E-2	1.3E-2	2.0E-2	2.1
Containment Spray Pump Fail to run (UD-16)	Harris PSA	2.7E-5	1.6E-5	8.5E-5	5.4
	ERIN 1	2.7E-5	1.6E-5	8.5E-5	5.4
Diesel Generator Fail to Start (UD-17)	Harris PSA	7.1E-3	6.4E-3	1.3E-2	2.0
	ERIN 1	7.8E-3	7.3E-3	1.3E-2	1.9
Chiller Fails to run (UD-20)	Harris PSA	7.8E-5	7.6E-5	1.1E-4	1.5
	ERIN 1	7.8E-5	7.5E-5	1.1E-4	1.5
	ERIN 2	1.0E-4	9.9E-5	1.7E-4	1.8

[1]METHODS: Harris PSA: As calculated in Harris PSA using numerous steps converting between several assumed distributions

ERIN 1: Use of lognormal prior distribution, binomial likelihood for demand, and Poisson likelihood for run; otherwise same generic means, range factors and plant specific evidence as in Harris PSA

ERIN 2: Same methodology as ERIN 1 but with increased range factor to correct inconsistency between assumed generic distribution and plant specific evidence.

- In the analysis of the Chiller failure rate for failure to run (UD-20), the plant specific evidence of 9 failures in 76451 hours whose point estimate is 1.18E-4 per hour seems inconsistent with the assumed prior distribution. The probability of observing so many failures in this exposure time is very low under the assumptions of the prior distribution. In Table 2-5 a revised analysis is performed (ERIN 2) in which the prior distribution has been revised to increase the range factor to 5 to be more consistent with the evidence. As seen in the table the results are sensitive to the assumed prior distribution. The Harris PSA procedure should be revised to check the consistency of the prior distributions and the evidence and adjustments like this should be made before accepting the results of the Bayes update.
- Maintenance data treatment used same inconsistent methods as initiating events; purely generic data for most components and purely plant specific data

for selected components. A consistent Bayes' update approach could be used as with failure rates.

- Very good example of how common cause events should be modeled and how data should be screened and mapped for plant specific application. The common cause data source is somewhat outdated and should be updated using the INEEL database.

A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-6.

Table 2-6

Evaluation of Data Analysis Element

Attribute	Assessment
Guidance/ Documentation	It is not known whether CP&L has any separate guidance documents but the Data Analysis Documentation is very thorough and hence, serves as useful guidance to support PSA updates.
Plant Specific Component Data	Generic database for component failures is well documented. Plant specific data was only incorporated for selected components including pumps, emergency diesel generators, and chillers. No valid basis for excluding other risk significant components was provided. The Bayes' update methodology employs a sequence of modeling assumptions to take advantage of conjugate properties, but independent verification of these calculations indicates some discrepancies in comparison with a more straightforward Bayes' update procedure. In one case, chiller failure to run, the plant specific evidence was inconsistent with the assumed generic distributions.
System/ Train Unavailabilities	Plant specific maintenance unavailability data was collected for the same limited set of components as was used for failure rate determination. Generic maintenance data was used for other components. As with the initiating event frequencies, inconsistent methods were used to quantify the plant specific and generic maintenance unavailabilities: classical statistics used for analyzing plant specific data, but Bayesian method used for those quantified using generic data.
Common Cause Failure Quantification	The common cause failure analysis including the selection of components for CCF modeling, plant specific screening and mapping of CCF data and justification and documentation of data interpretation assumptions is excellent. The only aspect of the common cause analysis that could be improved significantly is the incorporation of the INEEL common cause database.
Unique Unavailabilities and Modeling Issues	Unique modeling unavailabilities are documented in the system notebooks and throughout the report. Offsite power recovery should be updated to incorporate the latest industry offsite power recovery data.

Attribute	Assessment
Recommended Enhancements	A more straightforward, less convoluted, and consistent Bayes' update procedure should be used for initiating event frequencies, failure rates and maintenance unavailabilities. The use of narrow generic distributions that are inconsistent with the plant specific evidence should be avoided. Plant specific data should be applied for all risk significant components. The excellent treatment of CCF data should be updated to incorporate the INEEL CCF database.
Overall Process Assessment	This element of the Harris PSA, with the exception of the excellent treatment of common cause, was not up to the level of quality of most other aspects of the PSA. While the data values used in the PSA are reasonable, the data handling methods for failure rates and maintenance could be improved. The current data treatment should be adequate for risk ranking and most risk informed applications but should be enhanced for risk informed applications in which the plant specific equipment performance is an issue.
Recommended Element Grade: ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities ■ **Grade 2 - Supports Risk Ranking Applications** ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input ☐ Grade 4 - Provides Primary Basis For Application	

2.6 HR – HUMAN RELIABILITY ANALYSIS

The scope of this element includes the systems analyses that support the PSA including the identification of system functions addressed in the PSA, system success criteria, system dependencies, potential for causing an initiating event, fault tree models that support the accident sequence models, and probability models to support the accident sequence quantification. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-7.

Table 2-7

Evaluation of Human Reliability Analysis Element

Attribute	Assessment
Guidance	It is not known whether CP&L has any separate guidance documents but the Human Reliability Analysis Documentation provided in Appendix E is very thorough and hence, serves as useful guidance to support PSA updates.
Pre-Initiator Human Actions	A reasonably complete treatment of pre-initiator Human Actions was provided in Annex A. A good basic treatment of these events is provided and is well documented.
Post Initiator Human Actions	Both ASEP and THERP methods were used for post initiator human actions and these are very well documented in Annex B and C. A good basic treatment of these events is provided and is well documented.
Treatment of Dependencies	Human actions were placed directly on the fault trees, which necessitated an evaluation to see if multiple human errors would impact sequence truncation and quantification. The version of the quantification that was described used a relatively high truncation frequency of $1x10^{-8}$ per year only found two cutsets that had been screened out. This procedure should be extended to a lower truncation no greater than $1x10^{-10}$.
Documentation	The documentation of the human reliability analysis in Appendix E Annex's A, B, C, and D was excellent.
Recommended Enhancements	Dependencies among multiple HEPs were performed for the 1995 model. The relatively high truncation value (1E-8/yr) indicated only two cases to be addressed. It may be prudent to reevaluate this multiple HEP assessment in the future. These multiple operator actions are believed to impact principally those sequences contributing to late containment failure sequences or to SGTR.
Overall Process Assessment	The Harris PSA includes a treatment of human reliability analysis that is sufficient to treat risk-informed applications.
Recommended Element Grade: ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities ☐ Grade 2 - Supports Risk Ranking Applications ■ **Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input** ☐ Grade 4 - Provides Primary Basis For Application	

2.7 DE – DEPENDENCIES

The scope of this element includes the treatment of dependent failures between and among systems and initiating events due to functional, physical, and human sources. Treatment of common cause failures and spatial dependencies due to internal hazards such as flooding are also included in this element. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-8.

Table 2-8

Evaluation of Dependency Analysis Elements

Attribute	Assessment
Guidance/Documentation	It is not known whether CP&L has any separate guidance documents but the Dependency Analysis Documentation is very thorough and hence, serves as useful guidance to support PSA updates.
Dependency Matrices	The Harris PSA did not include dependency matrices, however the system dependencies are delineated separately on a system by system basis in the system notebooks. A more holistic consolidation of dependencies in a single place would make it easier for system engineers to validate plant to model fidelity.
Common Cause Failure Treatment	The common cause failure treatment including a comprehensive set of components and failure modes, and the plant specific screening and mapping of CCF data was excellent.
Spatial Dependencies	The internal flooding analysis is excellent including the screening of flooding scenarios, treatment of a range of flood rates, analysis of spatial interactions, and detailed quantification of high-risk scenarios. The documentation of this aspect of the PSA was the best that this reviewer has seen.
HI Dependencies	The treatment of HI dependencies was adequate but could have been improved by extending the examination of truncated sequences down to a truncation frequency of 1×10^{-10}.
Recommended Enhancements	Add dependency matrices, extend common cause data analysis to include the INEEL common cause data base, and extend the HI dependency treatment to 1×10^{-10} per year.
Overall Process Assessment	The current dependency treatment is adequate to support risk informed applications and with the recommended enhancements would provide the primary basis for application.

Recommended Element Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input
- © **Grade C4 - Provides Primary Basis For Application (Conditions)**

2.8 ST – STRUCTURAL RESPONSE

The scope of this element includes the structural analyses that support key aspects of the PSA. These structural issues include the success criteria for vessel integrity during severe over pressure and over cooling transients, the capability of the containment in response to severe accident challenges, and the modeling of the response of low pressure piping when exposed to high pressure loads during an interfacing systems LOCA evaluation. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-9.

Table 2-9

Evaluations of Structural Analysis Elements

Attribute	Assessment
Guidance	It is not known whether CP&L has any separate guidance documents but the PSA documentation of the structural analysis is very thorough and hence, serves as useful guidance to support PSA updates.
RPV Capability	FSAR success criteria are used for RV overpressure protection functions and this represents a potential conservatism in the ATWS evaluation, however due to the low frequency contribution of ATWS this does not distort the results unduly. It does not appear that overcooling transients and reactor vessel failures due to pressurized thermal shock have been modeled, however these sequences even when modeled do not normally contribute noticeably.
Containment Capability	A plant specific containment pressure capacity analysis was performed and the dependence on containment temperature was considered. This aspect of the evaluation was technically sound.
Pipe Overpressurization	The treatment of pipe overpressurization in the interfacing system LOCA evaluation was technically sound.
Recommendations for Enhancements	Maintain this quality level as the PSA experiences future updates
Overall Process Assessment	This element of the PSA is capable of supporting any envisioned risk informed application.

Recommended Element Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ■ **Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input**
- ☐ Grade 4 - Provides Primary Basis For Application

2.9 QU – QUANTIFICATION

The scope of this element includes the parts of the PSA not considered in the previous elements to support quantification of CDF and interpretation of the results. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-10.

Table 2-10

Evaluation of Level 1 Quantification Element

Attribute	Assessment
Guidance/ Documentation	Very good guidance (HNP-F/PSA-0001) on quantification and recovery. This procedure contains a step-by-step process for duplicating the documented results with the controlled model and quantification files. FLag files, mutually exclusive event files and recovery files are explicitly documented. Minor point, but rearange Table 6-1 in decreasing CDF order instead of alphabetically by sequence name (i.e., same order as Section 6.1.1). The summary of results in Section 1 is weak; at least discuss the top few sequences instead of just showing pie charts and saying, "nothing really dominates - see Section 6."
Dominant Accident Sequences	Very good guidance (HNP-F/PSA-0001) on quantification and recovery. This procedure contains a step-by-step process for duplicating the documented results with the controlled model and quantification files. Flag files, mutually exclusive event files and recovery files are explicitly documented. Minor point, but rearrange Table 6-1 in decreasing CDF order instead of alphabetically by sequence name (i.e., same order as Section 6.1.1). The summary of results in Section 1 is weak; at least discus the top few sequences instead of just showing pie charts and saying, "nothing really dominates - see Section 6."
Truncation/Recovery Analysis	Truncation in the most recent calculation file (2000 model) was 4E-9 in contrast with the 1E-8 level in the PSA report. This is 1E-4 less than CDF and is consistent with current industry standards. The documentation cites the largeness of the SHNPP fault trees and the excessively large number of cutsets that would result from lower truncations as justification. The recovery analysis uses the rule-based EPRI R&R QRECOVER software to apply recoveries to sequences on a detailed, systematic and reproducible basis.
Uncertainty	No statistical uncertainty analysis of the results was apparent.
Results Summary	Documentation in Section 6.1.1 is strong on what has been done. The documentation does not generally cover the underlying reasons or assumptions regarding why certin choices are made. For example, on top sequence TQUB (30.92% of CDF), why is it that fails seal cooling in the internal flooding sequences? Why does the TDEFW pump fail when the battery depletes? The presentation of key assumptions in the the summary is good but a discussion of the impact of these assumptions on the results is missing.

Attribute	Assessment
Recommended Enhancements	Document an uncertainty and sensitivity analysis and provide engineering insights into the results; update the results summary to account for the more recent update.
Overall Process Assessment	The quantification element subject to the recommended enhancements is capable of supporting risk informed applications.
Recommended Element Grade: ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities ☐ Grade 2 - Supports Risk Ranking Applications © **Grade C3 - Supports Risk Significance Evaluations w/Deterministic Input(Conditions)** ☐ Grade 4 - Provides Primary Basis For Application	

2.10 L2 CONTAINMENT PERFORMANCE

The scope of this element includes the interface with the Level 1, the containment event tree structure, the phenomena considered, applicable systems and operator actions, and end states. A summary evaluation of the technical quality and adequacy of this element is provided in Table 2-11. The key points from this evaluation are summarized below. Comments relevant to the overall Level 2 analysis are presented in Section 2.10.1, while detailed comments on the interfacing systems LOCA analysis are provided in Section 2.10.2.

2.10.1 Comments on Overall Level 2 Analysis

The overall Level 2 Analysis is state of the art and is considered a key strength of the Harris PSA. Specific comments are found in Table 2-11.

2.10.2 Comments on ISLOCA Analysis

Due to the importance of ISLOCA sequences as a contributor to LERF for the Harris PSA, a special review was performed to identify the need for any updates to provide a more realistic evaluation of these events.

General Comments in ISLOCA

- There are combinations of failure modes included that do not make physical sense. Until the inboard valve is failed (by rupture, leak, or mispositioning, if possible) the outboard valve(s) have no demand and cannot be questioned. The only way an outboard valve can be "holding" is if the inboard valve has already failed in some way.
- Common cause failures of valves in the rupture failure mode should not be modeled. Any conceivable maintenance errors that might be called common cause rupture would be discovered long before reaching full power operation.
- The rupture and leak failure modes can be combined, since a rupture is just a large sized leak and they are both time-dependent failures. Frequencies can be determined as done for Seabrook, using a Frequency vs. Leak Rate plot developed from actual data.
- The discussion of low pressure pipe failure due to overpressurization should include at least some discussion of other possible pressure boundary failures, i.e., pump seals, bolted flange connections, valve packing, valve body rupture, etc.

RHR Suction Lines

- The model for these lines does not include the leak failure mode. Combining the leak and rupture failure modes would take care of this. If leaks were modeled, they would have to exceed the flow capacity (900 gpm) of the relief valve in the low-pressure portion of the line in order to pressurize the low-pressure piping.
- Rupture of the outboard valve followed by rupture of the inboard valve is not a credible scenario. (See General Comments Above)

- Failure of the inboard valve to hold on demand is not a credible failure mode. The inboard valve always sees the same pressure during power operation.

LHSI Cold Leg Injection Lines

- The failure modes 'Fails Stuck Open' and 'Fails to Hold on Demand' are just different ways to describe 'Fails to Reseat' and should not both be included for these check valves.

- Common cause failures by the rupture failure mode and the leak failure mode should not be included. (See General Comments Above)

Table 2-11

Evaluation of Level 2 Element

Attribute	Assessment
Guidance/ Documentation	It is not known whether CP&L has any separate guidance documents but the PSA documentation of the L2 containment analysis is very thorough and hence, serves as useful guidance to support PSA updates. The documentation is excellent.
Level 1/Level 2 Interface	The interface is provided by a bridge event tree that links the Level 1 ET and Containment Event tree. The Bridge Tree supports the definition and assignment of a comprehensive set of plant damage states that are sufficient to capture severe accident issues relevant to PWRs with large dry containments. This part of the Level 2 analysis is very clearly documented and is technically sound.
Containment Event Tree Phenomena, Systems, Human Actions, Success Criteria	The CET considers all the severe accident phenomena that are expected for this plant and containment type and account for all the relevant NUREG-1150 issues. In addition, direct corium attack of the liner was identified and modeled as a result of plant specific evaluation of containment features. Success criteria for in-vessel recovery, arrest of corium attack of basemat via debris bed cooling, and time windows for restoring vessel and core cooling are reasonable. This part of the Level 2 analysis is very clearly documented and is technically sound.
Containment Capability Assessment	A plant specific probabilistic evaluation of the containment failure modes was performed and used to convolute against the assessed pressure and temperature loads to calculate the containment failure probability. This part of the Level 2 analysis is very clearly documented and is technically sound.
CET End States	The CET release categories provide an adequate spectrum of possible containment releases to support source term definition and calculations.
LERF Definition	The PSA does not calculate a LERF but provides sufficient information on the definition of the release categories to estimate LERF.

Attribute	Assessment
Recommended Enhancements	The interfacing system LOCA frequencies are considered to be conservative due to inclusion of inappropriate common cause failure modes and due to application of conservative data for valve failures. It is expected that an updated evaluation would support up to a one order of magnitude reduction in V-LOCA frequency. Some of the CET probabilities are simply assigned based on qualititatve judgements and could be questioned as to their basis, but seem to be reasonable. More could be done to compare these assessments to industry or NUREG-1150 results, however no significant changes in the results would be expected, only deeper insights into the contributors to the Level 2 results.
Overall Process Assessment	This Level 2 analysis is state of the art for plants in its peer group and is already sufficient to support risk significant determinations with deterministic input. Incorporation of enhancements would bring this PSA element to a level sufficent to provide the primary basis for decision making.

Recommended Element Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input
- © **Grade C4 - Provides Primary Basis For Application (Conditions)**

2.11 MU – MAINTENANCE AND UPDATE PROCESS

As part of a normal WOG PSA Peer Review, there is an evaluation of the maintenance and update process. This more complete evaluation involves presentations by the PSA team, discussions regarding applications, review of onsite procedures, etc. Due to the nature of what is involved in this type of review, a peer review was not performed for this element. One comment that is made is that the PSA documentation, particularly the details provided on the use of the CAFTA and R&R Workstation tools to support the various steps of the quantification process, provides excellent guidance for future PSA updates. However, to review this element requires access to information not available to support this peer review, which is based on the review of the existing PSA documentation and models.

SECTION 3
SUMMARY OF RESULTS AND CONCLUSIONS

The results of the evaluation of the Harris PSA elements are summarized in Table 3-1. This table includes the projected PSA Peer Review Grades that the reviewers believe would occur from a full peer review according to the WOG PSA Peer Review Program (Reference [1]). Also included are the strengths and weaknesses of each PSA element that the formal peer review would normally be documented in the Fact and Observation forms. A more complete delineation of these points is found in Section 2.

On balance this PSA is viewed as one of the best-documented PSAs that the reviewers have seen. The systems analysis, thermal hydraulics analysis, containment performance analysis and the dependency analysis were especially well done and are projected for evaluations at grade Level 4 or close to this grade. With the exception of data analysis, which was assessed at grade Level 2, the remaining elements of the PSA were at or near grade Level 3 with only small numbers of issues to clear up in order to achieve this grade level.

The Harris PSA is viewed as capable of supporting risk-informed applications such as the spent fuel pool PSA evaluation that this review was performed in support of. In each application, the applicability of the strengths and weaknesses identified in this review should be reviewed and addressed to determine whether they impact the conclusions of the application. When such impacts are identified, they should be addressed via PSA updates, sensitivity analyses, and/or supplemental engineering analyses as appropriate to support the decisions or conclusions associated with the application. In the opinion of the reviewers, this PSA is in the upper quartile of PSAs in the nuclear industry today; when ranked in terms of the capability to support risk informed applications.

An important finding of the peer review is that the PSA can be used to assess the CDF, Containment Failure Frequency, and Containment Bypass Frequency. If all the specific technical issues raised in this review were resolved, and incorporated into a PSA update, it is expected that the estimated CDF values would be comparable to or lower than those reported in the Harris PSA report, however the uncertainties are larger than those quoted in the report due to the issues noted for the data element. If the issues impacting LERF were addressed in a similar fashion, it is expected that the current LERF results that are supported by the existing PSA be determined to be conservative primarily from conservatisms in the estimation of interfacing systems LOCA frequency.

Table 3-1 Summary of Harris PSA Review Findings

Element Code	PSA Element	Element Grade*	Strengths	Potential Enhancements
IE	Initiating Events	**3**	Excellent treatment of support system initiating events; Clear functional grouping and binning for sequence model; good use of fault trees for selected initiators	Mixture of classical statistics for some events and Bayes' treatment of other events; problems with system fault trees for initiators
AS	Accident Sequence Evaluation	**C3**	Very clear documentation of event trees, success criteria and interface with fault tree quantification; good use of ESDs; excellent Level 1/Level 2 interface	Loss of offsite power event tree shifts important details of the logic into the linked fault trees that are more difficult to review.
TH	Thermal Hydraulic Analysis	**4**	Excellent and traceable documentation	None
SY	System Analysis	**4**	Excellent and traceable system notebooks	None
DA	Data Analysis	**2**	Good generic database that is traceable to sources; excellent CCF data treatment	Only limited amount of plant specific data; inconsistent use of Bayes and statistical methods
HR	Human Reliability Analysis	**3**	Clear and transparent documentation	Treatment of dependencies limited to cutsets > $1x10^{-8}$; need to update offsite power recovery.
DE	Dependencies	**C4**	Excellent CCF treatment and internal flooding analysis	CCF data source could be updated to latest INEEL CCF; addition of dependency matrices and review by plant staff would ensure PSA reflects as-built plant.
ST	Structural Response	**3**	Good documentation	None
QU	Quantification	**C3**	Very good description of quantification process	Results summary includes basic information but is weak on insights; results summary should be updated
L2	Containment Performance	**C4**	Excellent state of the art treatment of all severe accident phenomena relevant to PWRs with large dry containments; clean Level 1/Level 2 interface.	No credit for SAMGs; conservative treatment of interfacing systems LOCAs; so that results for LERF are conservative
MU	Maintenance Update	**N/A**	This element was not evaluated in this review	This element was not evaluated in this review

*C indicates the grade is conditional on resolving specific issues noted in the evaluation summaries in Section 2.

SECTION 4
REFERENCES

[1] Nuclear Energy Institute, "Probabilistic Risk Assessment Peer Review Process Guidance", NEI-002, Draft, 2000.

[2] American Society of Mechanical Engineers, "A Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications(Draft)", Revision 12, May 30, 2000.

[3] INEEL, "Evaluation of Loss of Offsite Power Events at Nuclear Power Plants 1980-1996", NUREG/CR-5496, November 1998.

Attachment C

Summary of Reviews to Shearon Harris Nuclear Plant PSA, IPE and IPEEE

Date of Review	Subject and Scope of Review	Organization Performing Review
Nov-00	Peer Review of Shearon Harris PSA The Independent Peer Review team concluded that the Shearon Harris PRA was one of the best-documented PRAs that the reviewers had seen. The systems analysis, thermal hydraulics analysis, containment performance analysis and the dependency analysis were especially well done and were evaluated as grade Level 4 or close to this grade. Grade Level 4 is acceptable for use as a primary basis for developing licensing positions that may change hardware, procedures, requirements, or methods. The data analysis was assessed at grade Level 2. Grade 2 corresponds to the attributes needed for risk ranking of systems, structures, and components. The remaining elements of the PRA were at or near grade Level 3. Grade 3 means that the PRA is adequate to support regulatory applications, when combined with deterministic insights. The ISLOCA analysis was considered quite conservative compared with other similar plants. The ISLOCA initiating event frequency could be reassessed to make the PRA more realistic.	ERIN Engineering and Research, Inc.
Jan-00	NRC Staff's Evaluation of the Shearon Harris Nuclear Plant, Unit 1, Individual Plant Examination of External Events (IPEEE) Submittal (TAC No. M83627) The NRC staff performed a screening review for completeness and reasonableness considering the design and operation of the plant. A Senior Review Board provided further review.	NRC
Apr-98	Shearon Harris Nuclear Plant Probabilistic Safety Assessment Review of Sequence Solutions, Report RSC 98-06, Revision 0 The high-level review of the Harris PSA accident sequence results (CAFTA-generated cut sets) from the model of record assessed the plant system design and the PSA event trees to determine at a qualitative level what results could be reasonably expected. The review also identified the most important accident sequence contributors and determined their applicability based on expected plant response and general PSA modeling guidance.	Ricky Summitt Consulting

Jan-96	NRC Staff's Evaluation of the Shearon Harris Nuclear Plant Individual Plant Examination (IPE Submittal) (Serial HNP-93-835) (TAC No. M74418) The evaluation package consisted of the Staff Evaluation Report (SER), the contractor's Technical Evaluation Reports (TERs) and a summary of the IPE submittal on Internal Events.	NRC
Oct-93	Appendix K, Review Comment Resolution: 1. Initiating Events and Event Sequence Development 2. System Modeling 3. Component Failure Data 4. Human Reliability Analysis 5. Sequence Quantification 6. Documentation 7. System Models 8. Comments from INPO Team member 9. Cutset Review Meeting Appendix K is part of the supporting documentation prepared for the IPE submittal. The review team included CP&L members as well as members from the organizations listed.	 1. SAROS 2. SAROS 3. CP&L 4. CP&L 5. CP&L 6. CP&L 7. CP&L 8. INPO 9. SAIC, SAROS, NUS, INPO, CP&L

Attachment D

Plant-Specific Information Provided to ERIN

	Item Description
1.	ASLB Memorandum and Order (Ruling on Late-Filed Environmental Contentions), August 7, 2000, LBP-00-19.
2.	HNP PSA Model of Record (MOR2000) (.CAF, .BE and other related files and calculation HNP-F/PSA-0001, Rev1 documenting the model)
3.	Shearon Harris Nuclear Plant Probabilistic Safety Assessment Fuel Pool Cooling and Cleanup System Notebook, Rev0, RSC 99-14, March 1999 and associated .CAF and .BE files
4.	Fuel Pooling Cooling and Cleanup System Description (SD-116) and Design Basis (DB-110)
5.	Fuel Handling Building Drawings: CAR-2165-G002, G011, G012, G014-G026, G910-G914, G916-G918, F25006, F-25007, F-002506 and F-02507
6.	Heat Load Calculations: ESRs 96-00126, 97-00636, 00-00046
7.	"Containment Overpressure Capacity for the Shearon Harris Nuclear Power Plant, Unit No. 1" by EQE International, march 1993.
8.	HNP Procedures AOP-13, AOP-20, AOP-31, AOP-107 and AOP-116
9.	Reactor Auxiliary Building (RAB) heatup calculation (RAB.ZIP) and Appendix J of the HNP IPE, Rev0, October 1993, ISLOCA analysis from HNP IPE
10.	MAAP input for HNP
11.	Big Rock Point Nuclear Plant Zircaloy Oxidation Analysis prepared for Consumers Power by Sargent & Lundy, SL-5203, April 24,1998.
12.	Shearon Harris Nuclear Plant Probabilistic Safety Assessment Groundrules and Assumptions, Rev0, RSC 97-22, October 1997
13.	MAAP Parameter deck
14.	NUREG/CR-4982 (Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82), July 1987
15.	NUREG/CR-5176 (Seismic Failure and Cask Drop Analyses of the Spent Fuel Pools at Two Representative Nuclear Power Plants), January 1989
16.	NUREG/CR-5281 (Value/Impact Analyses of Accident Prevention and Mitigative Options for Spent Fuel Pools), March 1989
17.	NUREG-1353 (Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools"), April 1989
18.	NUREG/CR-6451 (A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants), August 1997
19.	NUREG/CR-0649 (Spent Fuel Heatup Following Loss of Water During Storage), March 1979
20.	"Final Draft Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Plants and Federal Register Notice Requesting Public Comments on Technical Study", February 15, 2000.
21.	NUREG-0575 Volumes 1 and 2 (Handling and Storage of Spent Light Water Power Reactor Fuel), August 1979
22.	MSLB Analysis Inside/Outside Containment (Raytheon =Washington Nuclear), Report No. 78704.1.3.2.01.10, August 13, 2000.
23.	NUREG-0575 Volume 3, August 1979.
24.	MAAP input deck

25.	RMA-028, "Review of WOG Severe Accident Management Guidelines as Applied to Shearon Harris", Rev0, July 1996.
26.	RMA-032, "Development of Shearon Harris Severe Accident Calculational Aids", Rev0, July 1996.
27.	Susquehanna Steam Electric Station, Units 1 and 2, Draft Safety Evaluation Regarding Spent Fuel Pool Cooling Issues (TAC. No. M85337), October 25, 1994.
28.	SECY-99-168, Improving Decommissioning Regulations for Nuclear Power Plants, December 21, 1999.
29.	AOP-013, Rev11, Fuel Handling Accident
30.	OP-112, Rev13, Containment Spray System
31.	OP-116, Rev17, Fuel Pool Cooling and Cleanup
32.	OP-143.3, Rev19, Demineralized Water
33.	HNP spent fuel pool drawings: CPL-2165-S-0805Rev7 and CPL-2165-S-0807Rev4.
34.	HNP IPE Appendix J, Attachment 3 (hardcopy of material not in APP_J.ZIP)
35.	HNPsum2000.xls, PSA summary of release categories
36.	NRC letter to David Lochbaum, Spent Fuel Pool Cooling Generic Review (TAC No. M88094) including 2 attachments: 1. AEOD/S96-02, Assessment of Spent Fuel Cooling, September 1996. 2. INEL-96/0334, Loss of Spent Fuel Pool Cooling PRA: Model and Results, September 1996. 3. The Potential for Propagation of the Self Sustaining Zirconium Oxidation Following Loss of Water in a Spent Fuel Storage Pool, Pisano, et al., Draft - Jan 1984
37.	SF-0040, Rev0, Spent Fuel Pools C and D Activation Project Thermal Hydraulic Analysis, November 10, 1998.
38.	NRC Report 7590-01-P, Draft Final Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (Draft for Comment), February 2000.
39.	Shearon Harris Nuclear Power Plant, Unit 1, Individual Plant Examination for External Events (IPEEE) Submittal, June 1995.
40.	NRC's Staff Evaluation of the Shearon Harris Nuclear Power Plant, Unit 1, Individual Plant Examination for External Events (IPEEE) Submittal (TAC No. M83627), January 14, 2000.
41.	IPE and supporting documentation
42.	Drawings: CAR-2165-G-011 through 021; CAR-2165-G-151 through G-156 and CPL-2165-S1308, G-808, S-1324, -G-824, S-1300, -G-800
43.	HNP Periodic System Review, Spent Fuel Pool Cooling (7110), June 20, 2000.
44.	HNP AMMS printout for System 7110 (Spent Fuel Pool Cooling) for 1993 through 1998.
45.	Various plant drawings – see attached table for complete listing.
46.	HNP MAAP runs/card image input decks
47.	HNP Procedure OMP-003, Rev12, Outage Shutdown Risk Management
48.	HNP Procedure OMP-004, Rev8, Control of Plant Activities During Reduced Inventory Conditions
49.	HNP Technical Specification 3/4.9.4 and Bases
50.	Assumed duration that containment is not isolated during refueling outage.
51.	Response to ERIN request: JPMs; Demin Flow; TSC guidance; Containment isolation assumption; HVAC characteristics
52.	Response to request for additional information
53.	Fire cutsets Non-fire cutsets
54.	Basis for HNP fuel pool cooling pump unavailability. Basis for skimmer and purification pump values.

55.	HNP Steam Generator and IPEEE assumptions
56.	Power Source Locations
57.	IN 2000-13, NRC Information Notice, "Review of Refueling Outage Risk", September 27, 2000.
58.	Dose Calculation
59.	Source Term (not provided to ERIN; however, implicit in the dose calculation)
60.	Clarification: IPEEE/Tier 2 information Fire Area 1-A-4- COMB
61.	Availability of Fire Pumper Truck following seismic event
62.	Assumptions for RAB adverse environment
63.	System Description: SD-145, Rev5, Component Cooling Water System
64.	System Description: SD-156, Rev8, Plant Electrical Distribution System
65.	Operating Procedure: OP-145, Rev26, Component Cooling Water
66.	System Description: SD-139, Rev12, Service Water System
67.	CCW pump motors and pumps, EQ classification
68.	Power supply for Normal Service Water pumps
69.	Power Supply Question – FHB Crane
70.	LER 89-002-00 Spent Fuel Pool Draining
71.	Control Room Habitability – NEI Summary
72.	Extract from October 6, 2000 ACRS-Commissioners meeting
73.	FSAR 2.3.2 and wind rose data
74.	EOP-PP-013, Rev5, LOCA Outside Containment
75.	EOP-PP-012, Rev12, Loss of Emergency Coolant Recirculation
76.	Fire Brigade entry into FHB in a 190F environment
77.	PLP-201, Rev39, Emergency Plan
78.	Use of SFP as makeup source for core not identified in response guidance
79.	Dose calculations for 4 cases: Early and Late Containment Failure, Containment Isolation Failure and ISLOCA
80.	Reference for "Human Tolerance for Heat"
81.	Location of Water Treatment Building
82.	SGTR dose cases
83.	Revised Time-to-Boil Calculations
84.	Procedure FPP-013, Rev28, Fire Protection – Minimum Requirements and Mitigating Actions and recent history of Holly Springs FD backup
85.	Location of Water Treatment Building and other site structures
86.	Revised access times
87.	Revised access times – Chi/Q based on 10-year data summary

Drawings provided to ERIN
CAR-2168-G-500
CAR-2168-G-501
CAR-2168-G-501S02
CAR-2168-G-501S03
CAR-2168-G-501S04
CAR-2168-G-501S07
CAR-2168-G-501S09
CAR-2168-G-501S12
CAR-2168-G-501S13
CAR-2168-G-501S14
CAR-2168-G-501S15
CAR-2168-G-502S01
CAR-2168-G-502S02
CAR-2168-G-502S03
CAR-2168-G-502S04
CAR-2168-G-503S01
CAR-2168-G-524S03
CAR-2168-G-524S04
CAR-2168-G-532S05
CAR-2168-G-533
CAR-2168-G-539S03
CAR-2168-G-540S01
CAR-2168-G-555S06
CAR-2168-G-612S01
CAR-2168-G-800
CPL – 2165-S-2307
CPL – 2165-S-2308
CPL – 2165-S-2309
CPL – 2165-S-2310
CPL – 2165-S-2311
CPL – 2165-S-2312
CPL – 2165-S-2313
CPL – 2165-S-2314
CPL – 2165-S-2315

EXHIBIT 4

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No. 50-400-LA
	)	
(Shearon Harris Nuclear Power Plant)	)	ASLBP No. 99-762-02-LA

AFFIDAVIT OF R. STEVEN EDWARDS

COUNTY OF WAKE	)	
	)	ss:
STATE OF NORTH CAROLINA	)	

I, Robert Steven Edwards, being sworn, do on oath depose and say:

1. I am a resident of the State of North Carolina. I am employed by Carolina Power & Light Company ("CP&L") and work at the Harris Nuclear Plant ("HNP" or "Harris Plant" or "Harris") in the Nuclear Engineering Department. Presently, I am the Supervisor, Spent Fuel Pool Project, and am responsible for commissioning and placing into service Harris spent fuel pools C and D. My business address is 5413 Shearon Harris Road, New Hill, North Carolina 27562-0165.

2. I was graduated from North Carolina State University in 1982 with a B.S. in Industrial Engineering. Since graduation, I have been employed by CP&L, first

as an Associate Engineer, then Engineer, at the Robinson Nuclear Plant, responsible for planning, scheduling and execution of outages and major projects. Beginning in 1986, I served in the Technical Support Unit at Robinson as a System Engineer – Mechanical Systems. Promoted to Senior Engineer in July 1988, I supervised a staff of contract engineers responsible for specific projects at Robinson. In June 1991, I assumed the position of Project Engineer – Mechanical Systems at Robinson and managed a staff of four system engineers and two component engineers responsible for the operation, performance, reliability and maintenance of various plant systems. In August 1992, I became the Director – Information Architecture (Nuclear) in CP&L's Corporate Management Services and served as the management-level liaison and project manager for nuclear-related information technology projects at CP&L's nuclear plants. In October 1994, I moved to the position of Director – Project Control in the Corporate Nuclear Business Operations Group. In that position, I facilitated the development of long-range planning at each CP&L nuclear plant and provided oversight and administration of project management and economic evaluation processes and activities. In July 1996, I moved to Corporate Nuclear Engineering and became Manager of Projects, responsible for scope, cost, schedule, and quality of various nuclear projects. In April 1998, I was assigned to the Harris Major Projects Section and became responsible for the spent fuel pool C and D activation projects, including the completion of the spent fuel pool cooling and cleanup system ("SFPCCS"), spent fuel storage rack design and installation, and related activities. My resume is provided as Attachment A to this affidavit.

3. The purpose of this affidavit is to set forth the data and calculations on which CP&L relies in establishing the time to heat up the Harris spent fuel pools to boiling, and after boiling has started, the additional time necessary to then boil the coolant level down to the top of the spent fuel racks. First, I summarize the background of the license amendment request and the information submitted in support of the application. Second, I describe the Harris spent fuel pool physical arrangement and associated equipment. Third, I discuss the types of heatup calculations used and their applicability to the Harris spent fuel pools. Fourth, I discuss the data and assumptions used in calculations. Finally, I describe the results of the calculations.

BACKGROUND

4. CP&L's application for a license amendment to place spent fuel pools C and D in service was submitted on December 23, 1998. As the project manager for the Harris spent fuel pool C and D activation projects, I was responsible for development of the factual information set forth in the license amendment request. The information in the license amendment request, as updated by additional information subsequently submitted, is accurate to the best of my knowledge and belief.

5. The license amendment request and the need to expand spent fuel storage at Harris results from the failure of the U.S. Department of Energy ("DOE") to begin taking delivery of spent fuel in 1998, as required by the contract between DOE and CP&L and by the Nuclear Waste Policy Act of 1982, as amended. CP&L originally requested that the license amendment to allow placement of spent fuel in spent fuel pools C and D be issued no later than December 31, 1999, as CP&L had planned to begin loading spent fuel in pool C starting in 2000. Further delays threaten to adversely impact CP&L's ability to maintain adequate spent fuel storage capacity and, with the loss of full core discharge capability at one or more of CP&L's nuclear plants, could lead to a forced shutdown condition.

6. The NRC Staff reviewers requested additional information regarding the license amendment request by letters dated March 24, 1999, April 29, 1999, June 16, 1999, August 5, 1999, September 20, 1999, and by conference calls on March 30, 2000 and April 4, 2000. CP&L responded to each request for additional information ("RAI") respectively on April 30, 1999, June 14, 1999, July 23, 1999, September 3, 1999, and October 29, 1999, and April 14, 2000. CP&L also provided additional information to the NRC Staff on October 15, 1999 and July 19, 2000, to supplement previous responses. As the project manager for the Harris spent fuel pool C and D activation projects, I was responsible for development of the factual information set forth in the responses to the NRC

Staff. Following the Board's Memorandum and Order dated August 7, 2000, I was also responsible for development of factual information responsive to the NRC and BCOC discovery requests. The information in each of those responses, as supplemented, remains accurate to the best of my knowledge and belief.

7. I have previously given an affidavit in this matter on December 30, 1999. The information in that affidavit remains accurate to the best of my knowledge and belief.

8. Harris was originally planned as a four nuclear unit site (Harris 1, 2, 3 and 4). Harris 3 and 4 were canceled in late 1981. Harris 2 was canceled in late 1983. Spent fuel pools A, B, C and D and the spent fuel pool cooling and cleanup system ("SFPCCS") for spent fuel pools A and B were completed as part of the Harris fuel handling building, are described in the Harris Final Safety Analysis Report ("FSAR"), and are licensed as part of Harris.

9. Construction on the SFPCCS for spent fuel pools C and D was discontinued after Harris 2 was canceled. By that time, concrete had been poured, all four spent fuel pools had been constructed, and the SFPCCS piping immediately outside and under the spent fuel pools was installed, welded in place and embedded in reinforced concrete. The SFPCCS for spent fuel pools A and B was completed and placed in service. Harris 1 began commercial operations in 1987. Sometime in late 1988 or 1989, before the first discharge of spent fuel and refueling of Harris 1, spent fuel pool A was filled with borated water. Spent fuel pool B was

filled with borated water on or about the time spent fuel was first discharged from the Harris reactor. Because spent fuel pools C and D are connected to spent fuel pools A and B by transfer canals, at some point in or after 1989, spent fuel pools C and D were also filled with borated water to allow the gates in the transfer canal to be opened without a loss of water and preclude an inadvertent partial drain-down of spent fuel pools A and B to spent fuel pools C and D.

HARRIS PLANT SPENT FUEL POOLS AND ASSOCIATED SYSTEMS AND EQUIPMENT

10. As the project manager for the activation of spent fuel pools C and D, my work encompasses analytical design and engineering evaluations, management of the hands-on physical implementation of the modifications to the SFPCCS, and inspection and preparation of the spent fuel pools themselves. As a consequence of my extensive work at Harris and with the Harris spent fuel pools, I am familiar with the physical layout, system configurations, equipment installations, operations, and operating procedures for Harris, as they relate to normal and alternate operation of the fuel handling building, the spent fuel pools, and associated support systems and equipment.

11. As Harris was originally envisioned as a four unit facility with a shared fuel handling building, the fuel handling building was designed and constructed with four separate pools capable of storing spent nuclear fuel. Spent fuel pools A and B were originally intended to support Harris Units 1 and 4. Spent fuel pools C

and D were originally intended to support Harris Units 2 and 3. In addition, the fuel handling building contains a cask unloading pool, which can be connected to any spent fuel pool through transfer canals.

12. The layout of the Harris fuel handling building is illustrated and described in detail in the Harris FSAR, sections 3.8.4.1.3 and 9.1. Each spent fuel pool and the cask unloading pool are interconnected by a main transfer canal, oriented in a north-south direction, and two fuel transfer canals, oriented east-west. The spent fuel pools and transfer canals contain sufficient amounts of water to facilitate safe fuel handling and storage activities. The spent fuel pools, transfer canals, and cask unloading pool contain openings for the underwater movement of fuel assemblies between the pools and transfer canals. These openings also allow the communication of water between the pools and transfer canals. Removable bulkhead gates are installed in the openings when there is a need to isolate a particular pool or canal from the others. The isolation function of the bulkhead gates is provided by stainless steel structural components and inflatable seals, which are installed around the sides of the gates that fit into slots in the pool and canal openings. The seals are normally inflated using instrument air supplied at the installed gate location.

13. The normal configuration of the spent fuel pools (*i.e.*, the configuration present 99% of the time an on annual basis) is with open communication (*i.e.*, the gates removed) between spent fuel pools A and B and the interconnecting south ("Unit

1/4") transfer canal. Plant Operating Procedure OP-116, section 8.27 requires that a "clear path" be maintained between pools A and B. The cask unloading pool is normally open with the gate removed between it and the north transfer canal. Spent fuel pools C and D are currently normally isolated from the main transfer canal and spent fuel pools A and B. This alignment is illustrated in Attachment B. The expected configuration of the spent fuel pools (*i.e.*, the configuration expected to be present 99% of the time on an annual basis) following approval of the pending license amendment request is with open communication between spent fuel pools A and B, the connecting transfer canal and the main transfer canal. The cask unloading pool will normally be connected to spent fuel pools C and D through their interconnecting north ("Unit 2/3") fuel transfer canal. Spent fuel pools C and D, and the cask unloading pool will be isolated from pools A and B by a gate installed at the cask unloading pool end of the main fuel transfer canal. This alignment is illustrated in Attachment C.

14. The original Harris design included a SFPCCS to service spent fuel pools A and B, and a separate SFPCCS to service spent fuel pools C and D. The SFPCCS for spent fuel pools A and B is in service. The SFPCCS for spent fuel pools C and D was not completed, but will be finished and placed in service to support spent fuel operations pursuant to the pending license amendment request.

SPENT FUEL POOL HEATUP CALCULATIONS

15. I directed that calculations be performed to determine two values for the Harris spent fuel pools: (1) the time to heat up the individual pools (A, B, C, D) to boiling temperature (*i.e.*, 212 degrees Fahrenheit) and (2) the additional time to boil the coolant level down to the top of the spent fuel racks. In addition, I directed calculation of the amount of water required to offset the boiling rate in gallons per minute ("gpm") for each case. In turn, I used these calculations to perform a "best estimate" analysis, meaning that assumed input values are based on normally expected operating conditions based on historical data and plant operating records.

16. As a first step, calculations using standard, commonly used heat transfer equations were performed. The individual calculation steps are described in Attachment D. The heatup and boiloff calculations were performed by Andrew Howe, a degreed nuclear engineer and civil engineer in the Harris Engineering Support Section with 18 years experience performing these types of calculations. Mr. Howe has been previously licensed as a Senior Reactor Operator and is currently assigned as the Harris spent fuel pool cooling and cleanup system engineer. The methodology and inputs were independently reviewed by Tom Scattergood, a second qualified engineer in the Harris Engineering Support Section. Mr. Scattergood has Bachelors and Masters degrees in mechanical engineering and over eight years experience performing this type of work.

17. I then used these heatup and boiloff calculations to prepare an analysis responsive to the Board's request for a "best estimate" analysis by revising the performance assumptions to reflect normally expected operating conditions based on historical data and plant operating records. My analyses resulted in three values for each scenario: (1) time to heat the pools to boiling temperature, (2) additional time to boil the water down to the top of the racks, and (3) makeup flowrate required to offset boiling. The calculations I performed were independently reviewed by Edison Morales, a licensed professional engineer and Harris mechanical engineer with over 29 years of relevant experience.

18. The final calculations were performed using a Microsoft Excel spreadsheet. Results were independently verified using manual techniques and a hand calculator.

DATA AND ASSUMPTIONS

19. The input values and initial conditions for the heatup calculations were obtained from several sources. A complete list of calculation input values and sources is provided as Attachment E.

20. Initial condition assumptions were based on current knowledge, existing license and administrative controls, and professional judgments on expected future operating conditions. In each case where a future condition could not be definitively established, a best estimate assumption of that condition was used. Key assumptions in this category include: (a) Beginning of Cycle heat load for

spent fuel pools A and B is assumed to be a base heat load from HNP Calculation SF-40, Spent Fuel Pools C and D Activation Project Thermal Hydraulic Analysis, dated November 10, 1998, which includes a one-third freshly discharged core after startup from a refueling outage; (b) spent fuel pool temperature at the initiation of the heatup is the temperature expected based on Harris historical operating records; (c) spent fuel pools C and D heat load is either 1 MBTU/hr (the maximum allowed by the pending license amendment request) or 15.6 MBTU/hr (the maximum calculated heat load with both pools C and D completely filled); and (d) the water level in the spent fuel pool and transfer canals is the normal pool level expected during plant operation. In addition, several conservative assumptions are incorporated in the heatup calculations, including: (a) water volume in the cask unloading pool was not considered (*i.e.*, gate 8 is assumed installed); (b) no credit is taken for heat transfer to the pool liners, concrete structure, or atmosphere; (c) no credit is taken for any makeup water addition after the initiation of the heatup.

21. Initial operating conditions for the spent fuel pools and transfer canals were established as the lineup expected during normal operation of the plant (*i.e.*, the configuration expected 99% of the time on an annual basis). In all scenarios, spent fuel pools A and B are interconnected through their transfer canal and connected to the main transfer canal (*i.e.*, gate 2 is installed and gates 1, 3 and 4 are removed). For the 1 MBTU/hr scenario involving spent fuel pool C, it is

interconnected with its transfer canal and isolated from the main transfer canal (*i.e.*, gate 7 removed and gates 5 and 6 installed). Spent fuel pool D is not considered (*i.e.*, gate 9 is installed) in the 1 MBTU/hr scenarios, as all the racks and fuel will be in spent fuel pool C. Gate 8 is also assumed to be installed, as the inventory of the cask unloading pool is conservatively not credited in the calculations. In the 15.6 MBTU/hr scenario, racks and fuel will be installed in spent fuel pools C and D and the pools will be interconnected through their transfer canal, but isolated from the main transfer canal (*i.e.*, gates 7 and 9 are removed and 5 and 6 are installed) and the cask unloading pool (*i.e.*, gate 8 installed to reflect the conservative assumption not to credit this water volume).

CALCULATION RESULTS

22. A table listing each heatup calculation and the results for each analyzed scenario is included as Attachment F. These calculations determined that if all cooling and makeup are lost to spent fuel pools A and B at the beginning of an operating cycle, it would take approximately 20.5 hours for the pools to heat up to boiling temperature. Once boiling begins, it would take an additional 7.2 days for the water in the pools to boil down to the top of the racks where uncovery of fuel could begin. During this period, approximately 54 gallons per minute of makeup water would needed to maintain water level in the pools constant. If all cooling and makeup is lost near the end of an operating cycle (when the heat load from the most recently discharged fuel has diminished significantly), it would take

approximately 38 hours for spent fuel pools A and B to heat up to boiling. Once boiling begins during this scenario, it would take an additional 13.5 days for the water in spent fuel pools A and B to boil down to the top of the racks. Approximately 29 gallons per minute of makeup water would need to be added to the pools to maintain water level in the pools constant. In the 1 MBTU/hr scenario (involving only spent fuel pool C), it would take 16 days for water in spent fuel pool C to reach boiling temperature if all cooling and makeup water is lost. Once boiling in spent fuel pool C begins in this scenario, boiling would have to continue uninterrupted for an additional 99 days for the pool C water level to boil down to the top of the racks. During this period only slightly more than two gallons per minute of makeup water would be necessary to offset the boiling rate. For the maximum calculated end of life heat loads in spent fuel pools C and D, the pools will heat up to boiling temperature in approximately 34 hours following loss of all cooling and makeup. Once boiling begins in the pools in this scenario, an additional 8.8 days without cooling or makeup is required for the water in spent fuel pools C and D to boil down to the top of the racks. During this period, approximately 34 gallons per minute of makeup water would needed to maintain water level in the pools constant. These calculations are in Attachment G.

23. The calculations performed to determine the best estimate time to boil, additional time to boil to the top of the racks, and makeup required to offset the boiloff rate

under different heat load scenarios were all performed using standard heat transfer techniques. These techniques are well understood and straightforward. These calculations used the same approach that has been historically employed at the Harris Plant to perform similar calculations. These calculations were performed by experienced and qualified engineers knowledgeable in both heat transfer and Harris plant design and operation. In addition, the inputs, methodologies and results were independently reviewed by experienced and qualified engineers.

24. As an additional check, the results of these calculations were compared for consistency with the spent fuel pool heat up rates identified in FSAR 9.1.3.3. (Amendment No. 50). The information contained in this section of the FSAR discusses expected heat loads and heat up rates through operating cycle 10. The FSAR identifies that under these conditions (which includes an assumed heat load in spent fuel pools A and B of 16.84 MBTU/hr) spent fuel pools A and B would heat up from 112.7°F to 137°F in 5.56 hours, which equates to a heat up rate of 4.37°/hr. The best estimate time to boil calculations determined that spent fuel pools A and B would heat up from 95°F to 212°F in 20.57 hours for the 25 MBTU/hr beginning of cycle heat load scenario, which equates to a heat up rate in spent fuel pools A and B of 5.69°/hr. The spent fuel pool A and B end of cycle scenario calculations determined that spent fuel pools A and B would heat up from 95°F to 212°F in 38.67 hours, which equates to a heat up rate of 3.03°/hr.

Based on these results, the minimum and maximum heat up rates calculated as best estimates range from 3.03°/hr to 5.69°/hr compared to a value based on the FSAR of 4.37°/hr. These values are consistent and the difference, to the extent they are significant at all, appear primarily because of different heat load assumptions (*i.e.*, 25 MBTU/hr and 13.3 MBTU/hr heat loads used in the best estimate calculations assume spent fuel pools A and B are 'full' at the beginning and end of an operating cycle. The 16.84 MBTU/hr heat load identified in the FSAR is a bounding heat load calculated through operating cycle 10, which is the current Harris fuel cycle). This comparison provides me a high level of confidence that the best estimate analyses produced results that appropriately characterize the expected plant performance under the postulated conditions.

25. The results of these calculations show that in the highly unlikely event that all cooling and makeup to the spent fuel pools is lost, a considerable amount of time is available for Harris operators to re-establish cooling or makeup flow in order to prevent the spent fuel pool water level from boiling down to the point where fuel uncovery could occur. Even considering the worst case scenario where cooling and makeup is lost to 'full' spent fuel pools A and B at the beginning of an operating cycle, then the Harris Plant operators would have over 20 hours to take actions necessary to establish makeup or cooling flow before spent fuel pools A and B reached boiling temperatures. The plant operators would then have approximately an additional week to re-establish spent fuel pool cooling or make

up before the water level boiled down to the top of the fuel racks. Under this scenario, the operators would need to provide less than 54 gallon per minute of make up water in order to offset the boiling rate in spent fuel pools A and B. Since heat loads in spent fuel pools C and D are less than the corresponding heat loads in pools A and B, an even longer time is available to establish cooling or makeup flow to these pools.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 15, 2000.

R. Steven Edwards

R. Steven Edwards

Subscribed and sworn to before me
this 15 day of November 2000.

Darlene S. Yarborough

My Commission expires: 2-21-2005

DARLENE S. YARBOROUGH NOTARY *** PUBLIC HARNETT COUNTY, NC

R. Steven Edwards

Summary: Eighteen years experience in engineering, project management and outage management.

EXPERIENCE: Carolina Power & Light Company, June 1982 - Present

Supervisor, Spent Fuel Pool Project, Harris Plant, Nuclear Engineering (April 1998 - Present)

Project manager for Harris spent fuel pool 'C' and 'D' activation projects including spent fuel pool cooling and cleanup system completion, spent fuel storage rack design and installation, pool cleanup, and related activities. Responsible for all aspects of scope, cost, schedule and quality of projects. Responsible for study, design and implementation activities. Supervise multi-disciplined modification engineering staff that includes mechanical, civil and electrical engineers that develop plant design change modifications, oversee architect/engineer designs, write procedures, perform 10CFR50.59 analyses, perform ANSI N45.2.11 design verification reviews, and perform owner reviews of A/E developed modifications and calculations. Manage activities of various A/E engineers performing design activities including Bechtel, Sargent & Lundy, Duke Engineering, Raytheon, Protopower and Holtec. Responsible for development of License Amendment Request for SFP Activation project. Provide technical support to spent fuel communications team. Perform root cause evaluations. Serve as Emergency Response Organization Company Technical Spokesperson.

Manager of Projects, Nuclear Engineering (July 1996 - April 1998)

Project manager responsible for scope, cost, schedule and quality of various nuclear projects. Responsible for A/E design and analysis. Managed outsource engineering activities (scope development, schedule & cost management, AE negotiations & interface) for preferred and specialty engineering AE's and contractors. Provided group-wide oversight and administration of project management and economic evaluation processes, procedures and activities. Responsible for three-phase project authorization including value-added technical and financial review of projects requiring executive approval. Delivered economic evaluation module at NGG Business Concepts Course. Taught Project Cost Management module for Project Management Institute (PMI) project manager certification course. Developed and delivered various project management/ project controls presentations to industry groups such as Integrated Scheduling & Planning Utility Group (ISPUG) and Institute for International Research Budgeting and Forecasting Conference.

Director - Project Control, Nuclear Business Operations/ Operations & Environmental Support (October 1994 - July 1996)

Provided group-wide oversight and administration of project management and economic evaluation processes and activities. Lead development of NGG project management procedure. Responsible for three-phase project authorization. Developed and delivered project management and economic analysis training to plant personnel focusing on fundamentals and NGG specifics. Delivered various project management related presentations to industry groups and internal company management. Managed implementation of integrated project cost/schedule reporting system that combined FAIM financial data with Prestige schedule information. Developed and delivered economic evaluation module of NGG Business Concepts Course. Managed project budgeting team that implemented process to use Prestige schedule and resource data to build budget for plant projects. Facilitated development of Long Range Planning process at each nuclear plant. Project management peer group facilitator.

R. Steven Edwards

Director - Information Architecture (Nuclear), Management Services (August 1992 - October 1994)

Served as management-level liaison and project manager for nuclear related information technology projects. Provided technical and business process perspective for corporately implemented nuclear I/T projects. Coordinated the development of the nuclear portion of the Corporate Information Technology (I/T) Plan including administration of project prioritization process. Evaluated NGG generated requests for I/T products and services including evaluation of business justification, development of cost/benefit analyses and approval of I/S resource allocations.

Project Engineer - Mechanical Systems, Technical Support, Robinson Plant
(June 1991 - August 1992)

Managed staff of four system engineers and two component engineers responsible for operation, performance, reliability and maintenance of various plant NSSS, support and secondary mechanical systems and equipment such as high head safety injection, low head SI/residual heat removal, containment spray, reactor coolant pumps, liquid & gaseous waste disposal, steam generator blowdown, HVAC, make up water treatment, condensate polishing, etc. Provided extensive coaching and mentoring to staff with varied experience/education levels in development of their customer focused, performance oriented system and component engineering skills. Served as refueling outage Technical Support Shift Manager responsible for timely and successful completion of all engineering related outage activities through coordination of efforts with operations, maintenance, corporate engineering and other site management as well as supervision of engineers assigned to emergent activities and planned projects. Served on Emergency Response Organization as Accident Assessment Team - Mechanical Engineer and Emergency Communicator.

System Engineer - Mechanical Systems, Technical Support, Robinson Plant
Senior Engineer (July 1988 - June 1991); Engineer (November 1986 - July 1988)

Supervised staff of contract engineers responsible for specific projects including plant performance monitoring, procedure rewrite, backlog assessment, engineering training program, and work management system development (1990-1991).

System engineer responsible for operation, performance, reliability and maintenance of various mechanical systems including all plant HVAC, containment vessel (civil and support systems), LHSI/RHR, containment spray, post accident containment venting/H2 recombiner, primary and post-accident sampling, etc. (1986-1990). As system engineer, monitored system/equipment performance; performed surveillance tests; developed engineering evaluations, temporary plant modifications, procedures, 10CFR50.59 safety analyses, ANSI N45.2.11 design verification reviews, procurement engineering reviews, etc. Provided oversight to maintenance staff in troubleshooting system/equipment problems. Conducted root cause analyses. Served on Emergency Response Organization as Accident Assessment Team - Mechanical Engineer and Emergency Communicator.

Outage Planning and Scheduling Engineer, Outage Management, Robinson Plant
Engineer (June 1984 - November 1986); Associate Engineer (June 1982 - June 1984)

Responsible for planning, scheduling and execution of outages and major projects.

R. Steven Edwards

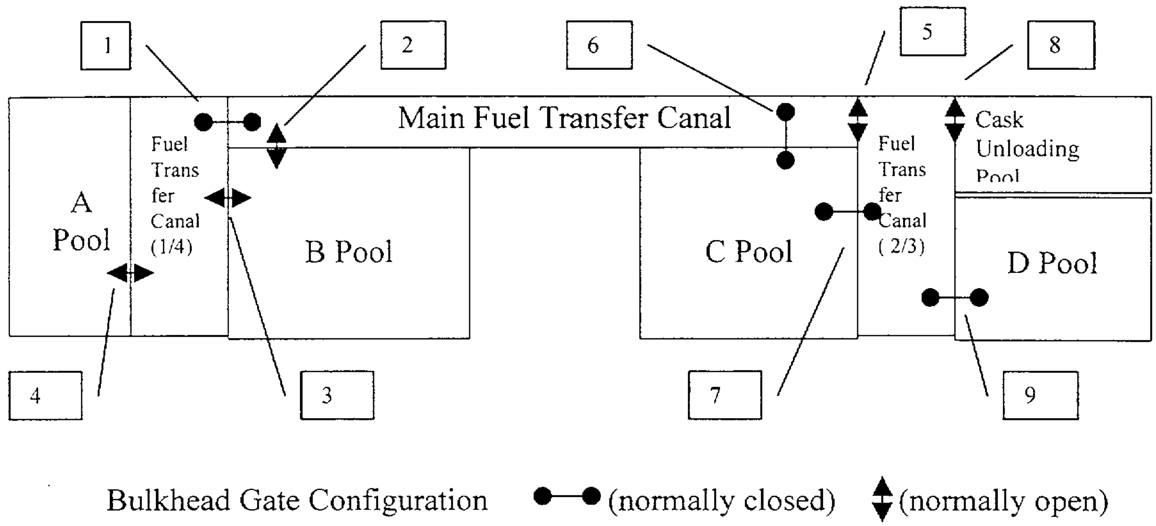
Developed detail and summary level schedules for forced outages, refueling outages, steam generator replacement outage and normal operating periods using manual CPM and ARTEMIS project management system. Led plan-of-day meetings. Served as field coordinator in outage management organization for major projects such as S/G eddy current.

PROFESSIONAL DEVELOPMENT: Attended American Management Association Project Management and Financial Analysis training, Reengineering Fundamentals Seminar, Harvard University In-Place Filter Testing Workshop, industry sponsored ANSI N510 Fan and Filter Testing Workshop, and NCSU Fundamentals of HVAC Design. Participated in company sponsored technical, project management and management/supervisory development training. Engineer in Training Certification - State of North Carolina.

EDUCATION: Bachelor of Science in Industrial Engineering, North Carolina State University, May 1982

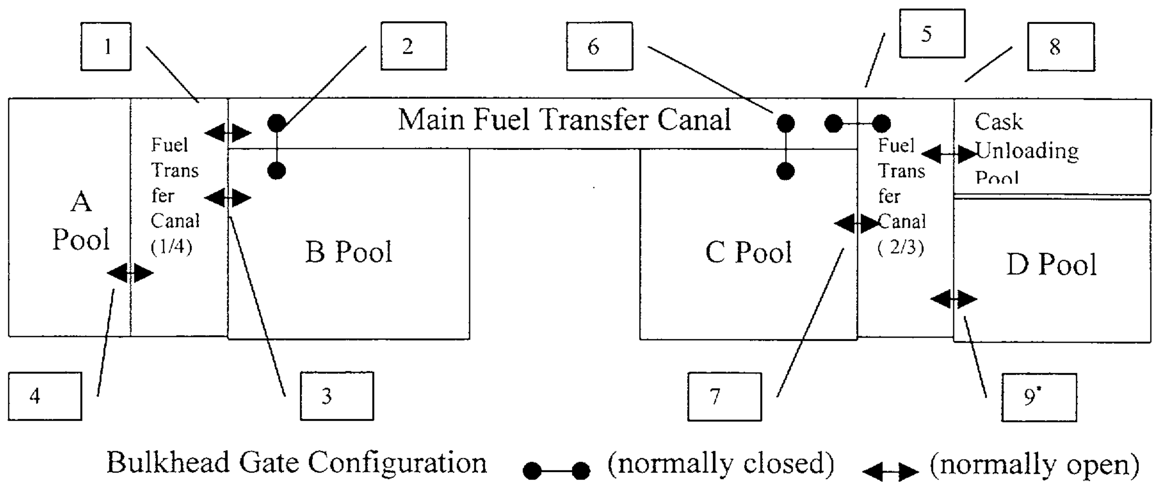
Attachment B

Diagram Illustrating HNP Spent Fuel Storage Pools, Transfer Canals, and Current Bulkhead Gate Configuration.



Attachment C

Diagram illustrating anticipated bulkhead gate configuration in the HNP spent fuel pools subsequent to operational use of C and D pools.



* The "normally open" configuration for gate 9 would apply subsequent to placing this pool in service that is scheduled for early the next decade. Otherwise, this gate would remain normally closed.

Attachment D

Description of the Key Steps in the Spent Fuel Pool Heatup Calculations

The following steps were taken in the calculation of spent fuel heatup and boiling:

Water volume

The amount of water available in the pools was determined by calculating the volume of the pools and then subtracting out the volume of the racks and the spent fuel. Since pools A and B are operated such that the pools remain interconnected and connected to the main transfer canal during all normal conditions, then the combined volume of the two pools, the main transfer canal and the Unit 1/4 transfer canal was considered together for these calculations. For the spent fuel pool A and B time to boil calculations, the water volume from the main transfer canal was not included; it was assumed that, due to its length and configuration, the temperature in the main transfer canal would lag behind the temperature in the pools during the heatup. However, the volume of water in the main transfer canal was included during the calculation of the additional time required to boil down to the top of the racks, since this water volume would definitely be available to displace water in the pools during the period when the boiling is actually occurring. Once both pools C and D are placed in service these pools will operate such that they will remain interconnected. Therefore, the combined volume of pools C and D and the Unit 2/3 transfer canal was considered together for these calculations.

Heat input required to raise the temperature of this water volume to boiling.

In the highly unlikely event that all cooling and makeup to the pools is lost, the heat input into the water from the spent fuel will cause the water temperature to increase. The amount of heat input required to increase the temperature of this volume of water from the normal expected temperature to boiling temperature was calculated using standard heat transfer equations.

Time required to reach boiling.

The heat input required to reach boiling divided by the heat load present in the pools yields the time required to reach boiling temperature. Best estimate heat loads were used to determine the time to boil under the specified scenarios.

Additional heat input required to boil the water to the top of the spent fuel racks.

The volume of the pools that is above the top of the racks was determined. Using this volume, the heat input required to change this volume of water from a saturated liquid to a saturated vapor was calculated using standard heat transfer equations.

Additional time to boil down to the top of the racks.

The heat input required to boil the water down to the top of the spent fuel racks was divided by the heat load in the pools to yield the additional time after the start of boiling required to reach the top of the racks. Best estimate heat loads were used to determine the time to boil off the water under the postulated scenarios.

Total time from initiation until the water has boiled down to the top of the racks.

The previously calculated time to boil plus the additional time to reach the top of the racks once boiling begins provides the total time available for the operators to reestablish either cooling or makeup to the pools in order to prevent uncovery of the fuel in the spent fuel pools.

Makeup flow rate required to offset boiling.

The rate (in gallons per minute) that the water is being boiled off was determined by dividing the previously calculated volume of water above the racks by the additional time required to boil the water down to the top of the racks. This boiloff rate is also the amount of makeup required to maintain pool level constant under boiling conditions.

Attachment E

Data Sources for Input Values and Initial Conditions

Nominal spent fuel pool level (284.5 ft)	CAR-2165-G-024, System Description SD-116 (Fuel Pool Cooling and Cleanup System), FSAR and DBD
Elevation of top of racks (260.08 ft)	CAR-2165-G-024, System Description SD-116 (Fuel Pool Cooling and Cleanup System), FSAR and DBD
Bottom of pools (246 ft)	CAR-2165-G-024, System Description SD-116 (Fuel Pool Cooling and Cleanup System), FSAR and DBD
Bottom of gates (260 ft)	CAR-2165-G-024, FSAR and DBD
Best estimate of spent fuel pool temperature at initiation (95°F)	Derived from historical spent fuel pool temperatures between August 1999 and September 2000 as recorded by the plant Emergency Response Facility Information System ("ERFIS") computer.
Pools A and B beginning of cycle heat load (25.0 MBTU/hr)	Core shuffle refueling alignment heat load from calculation SF-0040, "Spent Fuel Pools C and D Activation Project Thermal-Hydraulic Analysis." This heat load is the future expected heat load when pools A and B would be essentially full. This number is expected to be conservative since the number calculated in ESR 00-00046 for cycle 10 is less than 16.84 MBTU/hr.
Pools A and B base heat load at the end of an operating cycle (13.3 MBTU/hr)	Obtained from calculation SF-0040, "Spent Fuel Pools C and D Activation Project Thermal-Hydraulic Analysis."
Pools C and D initial licensed limit heat load (1.0 MBTU/hr)	Technical Specification limit in the pending License Amendment Request (HNP-98-188).

Pools C and D maximum end of life heat load (15.6 MBTU/hr)	ESR 95-00442 Action Item 2.
Specific Volume of water at 95°F (0.016115 cu ft/lb)	IAPWS 97 Formulation
Specific Volume of water at 212°F (0.016714554 cu ft/lb)	IAPWS 97 Formulation
Enthalpy of water at 95°F (63.0459 BTU/lb)	IAPWS 97 Formulation
Enthalpy of water at 212°F under saturated water conditions (180.1802 BTU/lb)	IAPWS 97 Formulation
Enthalpy of water at 212°F under saturated vapor conditions (1,150.2889 BTU/lb) – IAPWS 97 Formulation	IAPWS 97 Formulation
Density of water (7.48 gal/cu ft)	standard conversion formula
Pool A rack layout	Drawing CAR-2168-G-0124 S01 (Fuel Rack Arrangement Harris Fuel Pool "A")
Pool B rack layout	Drawing CAR-2168-G-0116 S01 (Fuel Rack Arrangement Harris Fuel Pool "B")
Pool A rack weights	Harris Plant procedure MMM-020
Pool B rack weights	Harris Plant procedure MMM-020
Pool C rack layout and weights	Holtec drawing 1994
Pool D rack layout and weights	Holtec drawing 1993
Specific weight of a spent fuel rack (0.29 lb/cu in)	Mark's Standard Handbook (stainless steel)
Volume of a BWR fuel assembly (1.164 cu ft)	Engineering Service Request 95-00584

Volume of a PWR fuel assembly (2.63 cu ft)	Engineering Service Request 95-00584
Pool A dimensions – (38 ft x 13 ft)	Drawing CAR-2165-G-022
Pool B dimensions – (50 ft x 27 ft)	Drawing CAR-2165-G-022
Pool C dimensions – (50 ft x 27 ft)	Drawing CAR-2165-G-022
Pool D dimensions – (32 ft x 20 ft)	Drawing CAR-2165-G-022
Unit 1/4 transfer canal dimensions (38 ft x 9 ft)	Drawing CAR-2165-G-022
Unit 2/3 transfer canal dimensions (38 ft x 9 ft)	Drawing CAR-2165-G-022
Main transfer canal (288 ft x 3 ft)	Drawing CAR-2165-G-022

Attachment F

Summary Results of Heatup Calculations for Analyzed Scenarios

Pools	Time to reach boiling temperature	Additional time for water level to reach top of racks	Total time	Makeup required to offset boiling
A and B (Beginning of cycle)	20.57 hours	7.21 days	8.07 days	53.70 gpm
A and B (End of cycle)	38.67 hours	13.56 days	15.17 days	28.57 gpm
C and D (1 MBTU/hr heat load)	384.66 hours	99.99 days	116.02 days	2.15 gpm
C and D (15.6 MBTU/hr heat load)	34.42 hours	8.80 days	10.23 days	33.64 gpm

	A	B	C	D	E	F
1		**Supporting Analysis for NRC Specific Interrogatory #7**				
2						
3		Request: Calculate the best estimate time to reach boiling temperature and then additional time for water level to boil down to the top of the racks				
4		Also calculated is the amount of makeup water required to offset the boiloff rate (in gpm)				
5						
6		**Assumptions:**				
7						
8		1	Gates 1, 3 & 4 are removed. Gate 2 is installed.			
9			Thus SFP A, SFP B, 1/4 transfer canal and main transfer canal are interconnected. This is normal lineup.			
10		2	Gate 7 is removed and gates 5 & 6 are installed for SFP C 1 MBTU/hr scenario. Thus SFP C and 2/3 transfer canal are interconnected for cooling.			
11			SFP D is not considered for 1MBTU/hr scenario since all racks and fuel will be in SFP C.			
12		3	Gates 7 & 9 are removed and gates 5 & 6 are installed for SFP C&D 15.6MBTU/hr scenario.			
13			Thus SFP C, SFP D and 2/3 transfer canal will be interconnected for cooling. This will be the normal lineup when SFP C&D are activated.			
14		4	Water volume in main transfer canal and cask unloading pool are not considered in this analysis.			
15		5	No credit is taken for any SFP cooling or makeup after initiation of the loss of cooling occurs.			
16		6	Beginning Cycle heat load for SFP A&B assumes base heat load from SF-40 plus 1/3 freshly discharged core after start up from a refueling outage			
17		7	No credit is taken for heat transfer to liner, concrete structure or atmosphere.			
18						
19						
20		**Inputs:**				
21						
22			Nominal water level	284.50	ft.	
23			Top of Racks	260.08	ft.	
24			Bottom of Pools	246.00	ft.	
25			Bottom of Gates	260.00	ft.	
26			Best estimate - SFP temp at initiation	95	deg. F	
27						
28			Pool A&B heat load	25,000,000	BTU/hr	Beginning of cycle
29			Pool A&B heat load	13,300,000	BTU/hr	Base heat load (end of cycle)
30			Pool C&D heat load	1,000,000	BTU/hr	Initial Licensed Limit
31			Pool C&D heat load	15,661,901	BTU/hr	End of Life heat load
32						
33			Water Properties:			
34			Specific Volume @ 95F (initation temperature)	0.016115214	cu ft/lb	
35			Specific Volume @ 212F (saturated liquid)	0.016714554	cu ft/lb	
36			Enthalpy @ 95F (initiation temperature)	63.0459	BTU/lb	
37			Enthalpy @ 212F (saturated liquid)	180.1802	BTU/lb	
38			Enthalpy @ 212F (saturated vapor)	1,150.2889	BTU/lb	
39				7.48	gal/cu ft	
40						
41			Rack & fuel volume:			
42			Pool A	1,675.85	cu ft	
43			Pool B	5,627.63	cu ft	
44			Pool C	6,449.04	cu ft	
45			Pool D	3,007.77	cu ft	
46						
47			Pool A water volume - total	17,343.15	cu ft	38ft x 13ft x (284.5 - 246)ft minus rack/fuel volume
48			Pool A water volume - to top of racks	12,063.48	cu ft	38ft x 13ft x (284.5 - 260.08)ft
49			Pool B water volume - total	46,347.37	cu ft	50ft x 27ft x (284.5 - 246)ft minus rack/fuel volume
50			Pool B water volume - to top of racks	32,967.00	cu ft	50ft x 27ft x (284.5 - 260.08)ft
51			Pool C water volume - total	45,525.96	cu ft	50ft x 27ft x (284.5 - 246)ft minus rack/fuel volume
52			Pool C water volume - to top of racks	32,967.00	cu ft	50ft x 27ft x (284.5 - 260.08)ft
53			Pool D water volume - total	21,632.23	cu ft	32ft x 20ft x (284.5 - 246)ft minus rack/fuel volume
54			Pool D water volume - to top of racks	15,628.80	cu ft	32ft x 20ft x (284.5 - 260.08)ft
55			1/4 transfer water volume to bottom of gates	8,379.00	cu ft	38ft x 9ft x (284.5 - 260)ft
56			2/3 transfer water volume to bottom of gates	8,379.00	cu ft	38ft x 9ft x (284.5 - 260)ft
57			Main transfer canal water volume	21,168.00	cu ft	288ft x 3ft x (284.5 - 260)ft
58						
59						
60						
61		**Pools A & B at the beginning of the cycle**				
62						
63		**Time to boil for A&B - beginning of cycle:**				
64			Volume available for saturation	72,069.52	cu ft	total volume of SFP A, SFP B & 1/4 canal
65			Mass	4,390,498.25	lb	total volume / specific volume
66			Heat input required to reach boiling	514,277,884.92	BTU	mass x (enthalpy @ initiation - enthalpy @ saturated liquid)
67			**Time required to boiling**	**20.57**	**hr**	heat input / heat load at beginning of cycle
68						
69		**Additional time to boil down to top of racks - beginning of cycle:**				
70			Volume available to top of racks	74,577.48	cu ft	volume to top of racks for SFP A, SFP B, main canal & 1/4 canal
71			Mass	4,461,828.86	lb	volume to top of racks / specific volume
72			Heat input required to reach top of racks	4,328,459,070.68	BTU	mass x (enthalpy @ saturated vapor - enthalpy @ saturated liquid)
73			**Time to reach top of racks**	**173.14**	**hr**	heat input / heat load
74			**or**	**7.21**	**days**	
75						
76		**Total time from initiation until top of racks:**				
77			**Time to boil + time to top of racks**	**193.71**	**hr**	
78				**8.07**	**days**	
79						
80		**Makeup required to offset boiling:**				
81			Volume to top of racks	74,577.48	cu ft	volume to top of racks for SFP A, SFP B, main canal & 1/4 canal
82			Volume to top of racks	557,839.55	gallons	convert cu ft to gallons (x by 7.48)
83			Time to boil to top of racks	173.14	hr	from above
84			**Make up flow rate required**	**53.70**	**gal/min**	volume to top of racks / time to top of racks after boiling begins
85						

	A	B	C	D	E	F
86						
87						
88		**Pools A & B at the end of the cycle**				
89						
90		**Time to Boil for A&B - End of cycle:**				
91			Heat input required to reach boiling	514,277,884.92	BTU	calculated above
92			**Time required to boiling**	**38.67**	**hr**	heat input / heat load at end of cycle
93						
94		**Additional time to boil down to top of racks - End of cycle:**				
95			Heat input required to reach top of racks	4,328,459,070.68	BTU	calculated above
96			**Time to reach top of racks**	**325.45**	**hr**	heat input / heat load at end of cycle
97			**or**	**13.56**	**days**	
98						
99		**Total time from initiation until top of racks:**				
100			**Time to boil + time to top of racks**	**364.12**	**hr**	
101			**or**	**15.17**	**days**	
102						
103		**Makeup required to offset boiling:**				
104			Volume to top of racks	74,577.48	cu ft	volume to top of racks for SFP A, SFP B & 1/4 canal
105			Volume to top of racks	557,839.55	gallons	convert cu ft to gallons (x by 7.48)
106			Time to boil to top of racks	325.45	hr	from above
107			**Make up flow rate required**	**28.57**	**gal/min**	volume to top of racks / time to top of racks after boiling begins
108						
109						
110						
111						
112		**Pool C at the initial licensed heat load of 1 MBTU/hr**				
113						
114		**Time to Boil for C - Initial Licensed Heat Load:**				
115			Volume available for saturation	53,904.96	cu ft	total volume of SFP C & 2/3 canal
116			Mass	3,283,907.43	lb	total volume/specific volume
117			Heat input required to reach boiling	384,658,158.06	BTU	mass x (enthalpy @ initiation - enthalpy @ saturated liquid)
118			**Time required to boiling**	**384.66**	**hr**	heat input / heat load at initial licensed limit
119			**or**	**16.03**	**days**	
120						
121		**Additional time to boil down to top of racks - Initial Licensed Heat Load:**				
122			Volume available to top of racks	41,346.00	cu ft	volume to top of racks for SFP C & 2/3 canal
123			Mass	2,473,652.58	lb	volume to top of racks / specific volume
124			Heat input required to reach top of racks	2,399,711,933.64	BTU	mass x (enthalpy @ saturated vapor - enthalpy @ saturated liquid)
125			**Time to reach top of racks**	**2,399.71**	**hr**	heat input / heat load
126			**or**	**99.99**	**days**	
127						
128		**Total time from initiation until top of racks:**				
129			**Time to boil + time to top of racks**	**2,784.37**	**hr**	
130			**or**	**116.02**	**days**	
131						
132		**Makeup required to offset boiling:**				
133			Volume to top of racks	41,346.00	cu ft	volume to top of racks for SFP C & 2/3 canal
134			Volume to top of racks	309,268.08	gallons	convert cu ft to gallons (x by 7.48)
135			Time to boil to top of racks	2,399.71	hr	from above
136			**Make up flow rate required**	**2.15**	**gal/min**	volume to top of racks / time to top of racks after boiling begins
137						
138						
139						
140		**Pool C&D at maximum end of life heat load of 15.6 MBTU/hr**				
141						
142		**Time to Boil for C&D - End of Life Heat Load:**				
143			Volume available for saturation	75,537.19	cu ft	total volume of SFP C, SFP D & 2/3 canal
144			Mass	4,601,749.81	lb	total volume/specific volume
145			Heat input required to reach boiling	539,022,686.79	BTU	mass x (enthalpy @ initiation - enthalpy @ saturated liquid)
146			**Time required to boiling**	**34.42**	**hr**	heat input / heat load at maximum end of life heat load
147			**or**	**1.43**	**days**	
148						
149		**Additional time to boil down to top of racks - End of Life Heat Load:**				
150			Volume available to top of racks	56,974.80	cu ft	volume to top of racks for SFP C, SFP D & 2/3 canal
151			Mass	3,408,693.98	lb	volume to top of racks / specific volume
152			Heat input required to reach top of racks	3,306,803,741.03	BTU	mass x (enthalpy @ saturated vapor - enthalpy @ saturated liquid)
153			**Time to reach top of racks**	**211.14**	**hr**	heat input / heat load
154			**or**	**8.80**	**days**	
155						
156		**Total time from initiation until top of racks:**				
157			**Time to boil + time to top of racks**	**245.55**	**hr**	
158			**or**	**10.23**	**days**	
159						
160		**Makeup required to offset boiling:**				
161			Volume to top of racks	56,974.80	cu ft	volume to top of racks for SFP C, SFP D & 2/3 canal
162			Volume to top of racks	426,171.50	gallons	convert cu ft to gallons (x by 7.48)
163			Time to boil to top of racks	211.14	hr	from above
164			**Make up flow rate required**	**33.64**	**gal/min**	volume to top of racks / time to top of racks after boiling begins
165						

EXHIBIT 5

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT	)	Docket No. 50-400-LA
COMPANY	)	
(Shearon Harris Nuclear Power Plant)	)	ASLBP No. 99-762-02-LA

AFFIDAVIT OF ERIC A. MCCARTNEY

COUNTY OF WAKE	)	
	)	ss:
STATE OF NORTH CAROLINA	)	

I, Eric A. McCartney, being sworn, do on oath depose and say:

1. I am a resident of the State of North Carolina. I am employed by Carolina Power & Light Company ("CP&L") and work at the Harris Nuclear Plant ("HNP" or "Harris Plant" or "Harris") in the Licensing Department. Presently, I am the Supervisor, Licensing/Regulatory Programs, and am responsible for managing regulatory interfaces for Harris. My business address is 5413 Shearon Harris Road, New Hill, North Carolina 27562-0165.

2. I was graduated from the University of Maryland in 1995 with a B.S. in Nuclear Science. Between 1974 and 1995, I have held several positions of increasing responsibility in nuclear power operations, first in the United States Navy, then

with CP&L. I obtained my Reactor Operator license in 1988 and have been a licensed Senior Reactor Operator since 1991. Since graduation from the University of Maryland, I have been employed by CP&L in supervisory positions, first as Superintendent – Shift Operations, responsible for shift activities including radioactive waste and makeup water systems at Harris. In 1997, I was appointed Harris Superintendent – Work Control, responsible for directing day-to-day licensed activities as the senior licensed operator onsite. Between January 1999 and April 2000, I was an Operations Evaluator for the Institute of Nuclear Power Operations ("INPO") performing evaluations of nuclear power plant operations. I also performed World Association of Nuclear Operators ("WANO") peer reviews and assistance visits at Donald C. Cook Nuclear Power Station and Fort Calhoun Nuclear Station. In April 2000, I was appointed to my current position of Supervisor – HNP Licensing/Regulatory Programs, where I am responsible for preparing regulatory reports, supporting plant operations, and participating on the Plant Nuclear Safety Committee. I have also served on the Technical Support Center ("TSC") staff as the Site Emergency Coordinator, responsible for operating decisions during emergency conditions. My resume is included as Attachment A to this affidavit.

3. The purpose of this affidavit is to set forth facts on which CP&L relies in establishing that numerous, diverse sources of water and methods of delivery exist for establishing makeup to the Harris spent fuel pools. <u>First,</u> I describe the Harris

spent fuel pool physical arrangement, systems configurations, and plant equipment associated with normal and alternate makeup to the spent fuel pools. Second, I discuss the methods available for supplying makeup water to the Harris spent fuel pools and identify the Harris procedures, controls, conditions, and equipment that establish the viability of each method. Third, I describe the TSC, its functions and personnel, and how the Severe Accident Management Guidelines ("SAMGs") are used to assist the operating staff in responding to emergency conditions outside of existing procedures. Finally, I provide my conclusions on the ability of Harris operators to restore makeup water to the spent fuel pools under emergency conditions.

HARRIS PLANT SPENT FUEL POOLS, ASSOCIATED SYSTEMS AND AVAILABLE EQUIPMENT

4. As a consequence of my extensive experience as a licensed operator and manager at Harris, I am familiar with the physical layout, system configurations, equipment installations, operations, and operating procedures for Harris, as they relate to normal and alternate operation of the fuel handling building, the spent fuel pools, and associated water sources, support systems and equipment.

5. As Harris was originally envisioned as a four unit facility with a shared fuel handling building, the fuel handling building was designed and constructed with four separate pools capable of storing spent nuclear fuel. Spent fuel pools A and B were originally intended to support Harris Units 1 and 4. Spent fuel pools C

and D were originally intended to support Harris Units 2 and 3. In addition, the fuel handling building contains a cask unloading pool, which can be connected to any spent fuel pool through transfer canals.

6. The layout of the Harris fuel handling building is illustrated and described in detail in HNP FSAR, section 9.1. Each spent fuel pool and the cask unloading pool are interconnected by a main transfer canal, oriented in a north-south direction, and two fuel transfer canals, oriented east-west. The spent fuel pools and transfer canals contain sufficient amounts of water to facilitate safe fuel handling and storage activities. The spent fuel pools, transfer canals, and cask unloading pool contain openings for the underwater movement of fuel assemblies between the pools and transfer canals. These openings also allow the communication of water between the pools and transfer canals. Removable bulkhead gates are installed in the openings when there is a need to isolate a particular pool or canal from the others. The isolation function of the bulkhead gates is provided by stainless steel structural components and inflatable seals, which are installed around the sides of the gates that fit into slots in the pool and canal openings. The seals are normally inflated using instrument air supplied at the installed gate location.

7. The normal configuration of the spent fuel pools (*i.e.*, the configuration expected 99% of the time an on annual basis) is with open communication (*i.e.*, the gates removed) between spent fuel pools A and B and the connecting transfer canal.

The gate between the transfer canal and the main fuel transfer canal is also normally removed. The cask unloading pool is normally connected to the main fuel transfer canal. Spent fuel pools C and D are currently normally isolated from spent fuel pools A and B by a gate installed between the main fuel transfer canal and pools C and D. This alignment is illustrated in Attachment B. Once placed in operation, spent fuel pools C and D and the associated fuel transfer canal will normally be connected to the cask handling pool. Spent fuel pools A and B and their shared transfer canal will be connected to the main fuel transfer canal. This alignment is illustrated in Attachment C.

8. The original Harris design included a spent fuel pool cooling and cleanup system ("SFPCCS") to service spent fuel pools A and B, and a separate SFPCCS to service spent fuel pools C and D. The SFPCCS for spent fuel pools A and B is in service. The SFPCCS for spent fuel pools C and D was not completed, but will be finished and placed in service to support spent fuel operations pursuant to the pending license amendment request.

9. The purpose of the SFPCCS is to maintain water quality in the spent fuel pools, transfer canals, cask loading pool and the reactor cavity, and remove residual heat generated in the stored spent fuel. The SFPCCS consists of a cooling system and a cleanup system. The major system components are the fuel pool heat exchangers, fuel pool demineralizer, fuel pool cooling pumps, filters, skimmers, water purification pumps, valves, piping, fuel pool gates, strainers,

instrumentation and system controls. The SFCCS is comprised of two separate cooling loops, each with 100% capacity and independence. The fuel pool cooling pumps are powered from train separated power sources with the capability of being connected to the emergency diesel generator should a loss of offsite power occur. The normal source of water for the system is the Refueling Water Storage Tank ("RWST"), which has a capacity of 469,000 gallons and is maintained above 436,000 gallons at all times during reactor operation. Attachment D is the system description, SD-116, from Volume 6 of the Harris Plant Operating Manual, which provides a more detailed description of the SFPCCS. Attachment E is a simplified schematic of the system.

10. The demineralized water system ("DWS") is designed to process filtered water from the filtered water makeup system to produce demineralized water sufficient for the expected demands during startup and operation of various Harris plant systems, including the reactor coolant system. The DWS is capable of supplying normal makeup needs with additional capacity for maintaining level in the condensate storage tank, refueling water storage tank, and reactor makeup water storage tank, which provide makeup water capacity to bring the plant to a shutdown condition during accident conditions. The major system components include: the demineralized raw water feed pumps, carbon filters, cation, anion and mixed bed demineralizers, a vacuum degassifier, degassified water transfer pumps, a demineralized water storage tank with a capacity of 500,000 gallons,

and demineralized water storage tank transfer pumps. Attachment F is the system description, SD-143, from Volume 6 of the Harris Plant Operating Manual that provides a more detailed description of the DWS. Attachment G is a simplified schematic of the system.

11. The RWST has two functions. First, it provides a borated water source for the charging safety injection pumps, containment spray pumps and residual heat removal pumps for injection into the reactor vessel during accident conditions that threaten core uncovery. The RWST is also a source of water to fill the fuel transfer canals for refueling operations. The RWST has a capacity of 469,000 gallons and is maintained greater than 92% at all times while the plant is operating. Technical Specifications require the engineered safety features actuation system to swap safety injection pump suction from the RWST to the containment sump at 23.4% RWST level to prevent possible safety injection pump damage. This leaves approximately 100,000 gallons of water available for use by other systems following safety injection. Attachment H is the system description, SD-112, from Volume 6 of the Harris Plant Operating Manual that provides a more detailed description of the RWST. Attachment I is a simplified schematic of the RWST and connecting systems.

12. The normal service water system ("NSW") circulates water from the cooling tower and cooling tower makeup system through plant auxiliary components and back to the cooling tower. The NSW provides cooling water to the ESW headers

during normal operations. The key components of the system include two (2) NSW pumps and interconnecting piping. The pumps are powered from non-safety auxiliary busses. The sources of water for NSW are the main and auxiliary reservoirs. Attachment J is the system description, SD-139 from Volume 6 of the Harris Plant Operating Manual that provides a more detailed description of the NSW System. Attachment K is a simplified schematic of the NSW System.

13. The emergency service water ("ESW") system circulates water from the ultimate heat sink ("UHS") through the plant components required for safe shutdown of the reactor following an accident and returns the water to the UHS. The ESW system provides an emergency source of water for the auxiliary feedwater system, essential services chilled water system and fire protection system. Key system components include two (2) ESW pumps and two (2) ESW booster pumps, are powered from safety-related buses. The sources of water for the ESW system are the main and auxiliary reservoirs. Attachment J is the system description, SD-139, from Volume 6 of the Harris Plant Operating Manual that provides a more detailed description of the ESW system. Attachment L is a simplified schematic of the system.

14. The reactor makeup water storage tank ("RMWST") serves as a storage volume for makeup water to nuclear steam supply system, specifically the component cooling water ("CCW") system and reactor coolant system ("RCS"). The RMWST has a capacity of 85,000 gallons. Attachment M is the system

description, SD-102, from Volume 6 of the Harris Plant Operating Manual that provides a more detailed description of the RMWST. Attachment N is a simplified schematic of the RMWST and connecting systems.

15. The purpose of the fire protection system is to ensure the capability to shut down the reactor safely, maintain it in a safe shutdown condition, and limit the radioactive release to the environment in the event of a fire. It also serves to minimize both the probability and the consequences of fires, thereby protecting plant personnel and plant related equipment and property. Two fire pumps are provided, one motor driven pump powered from a non-safety power supply and one diesel engine driven pump, each with a capacity of 2500 gallons per minute. Both fire pumps draw suction from the Auxiliary Reservoir. Attachment O is the system description, SD-149, from Volume 6 of the Harris Plant Operating Manual that provides a more detailed description of the Fire Protection System. Attachment P is a simplified schematic of the system.

16. Harris has agreements with the Holly Springs and Apex Fire Departments to provide assistance in emergency situations. The Apex fire station is approximately three miles from the Harris site. Generally, Holly Springs and Apex respond to the site in 15 to 30 minutes from the phone call requesting assistance. Additional emergency resources are available from Raleigh and Sanford fire departments, with which Harris has also established working relationships. These fire departments are familiar with Harris because they

participate in annual drills requiring off-site fire department response as part of the Harris Emergency Plan.

17. Harris Fire Brigade members are provided with a full set of structural fire fighting turnout gear and Self-Contained Breathing Apparatus ("SCBA") suitable for performing actions in high temperature and high humidity conditions. This gear includes boots, bib overalls, coat, hood and helmet. Harris turnout gear is generally manufactured from Nomex™ and Gortex™ materials, which are non-combustible and vent moisture during use.

18. Plant Fire Brigade members undergo initial and annual re-qualification LIVE Fire Training using turnout gear and SCBA. This training includes structural fire training (entry and extinguishing a actual structural fire) in a building. Fires during these training evolutions typically involve temperatures in the fire room well above the 195° F that is anticipated in the Harris fuel handling building during postulated spent fuel pool boiling. Temperatures in the range of 300° F would not be unusual during Fire Brigade training exercises. Fire fighting with a fire hose normally produces high humidity conditions and Fire Brigade members are trained to perform under such conditions. Additionally, Fire Brigade members conduct periodic drill in various plant locations to exercise their ability to use fire fighting equipment and techniques.

19. Emergency lighting is installed and regularly maintained in locations where operator actions may be required following a loss of normal lighting. In

particular, the plant areas containing valves and equipment necessary to provide normal and alternate fuel pool cooling and make up contain normal and emergency lighting, either of which is adequate to enable an operator to perform the actions required to establish flow to the fuel pools. In addition, portable, battery-powered flashlights and lanterns are available in each emergency facility and the control room. These storage locations are periodically inventoried to ensure the equipment is available and working. Normal and emergency lighting is more fully described in system description SD-158, Plant Lighting (Attachment Q).

20. Ladders are strategically located in designated ladder storage areas throughout the fuel handling and reactor auxiliary buildings. Ladder locations are marked with placards and a log is maintained in the operator's work area showing the location of ladders in the plant. These ladders are staged for the specific purpose of providing operators access to elevated valves and equipment, and operators are familiar with their locations.

21. Auxiliary operators are trained to operate locked doors and valve locking devices under normal and emergency conditions. The doors in the fuel handling building and reactor auxiliary building do not require electrical power to be operated manually. Power provides only alarm and indication for the security system. Each operator carries keys that operate plant doors, as well as keys for locked equipment, such as valves and tool boxes. Additional keys of both types are

maintained in the main control room. In addition, following the activation of the Emergency Plan, or on a loss of site power, security personnel are tasked to assist operating staff with access to locked areas. Finally, bolt cutters and torches can be obtained from the site tool room located in the service building. Operators and security personnel are trained and familiar with operating plant doors and equipment under normal and emergency conditions.

METHODS FOR SUPPLYING MAKEUP WATER TO THE HARRIS SPENT FUEL POOLS

22. There are numerous normal and alternate methods for supplying makeup water to the Harris spent fuel pools. To the best of my knowledge and belief, each of the ten (10) methods described below is individually capable of delivering makeup water to the spent fuel pools at a rate in excess of the highest evaporation or boil-off rates calculated for the beyond-design-basis accident with containment bypass scenario described in Contention EC-6.

23. In each method described below, makeup water will be available to each spent fuel pool regardless of the makeup water discharge location or the bulkhead gate configuration. Makeup is available to spent fuel pool A and B (and spent fuel pools C and D when they are placed in service) in the normal bulkhead gate configuration by open communication through the transfer canals. If makeup is required when a spent fuel pool is isolated by one or more installed bulkhead gates, makeup water can be made available simply by depressurization of the inflated gate seals. With the seals depressurized, makeup water will communicate

into, and equalize the levels of, the spent fuel pools, transfer canals, and cask unloading pool. The seals can be deflated locally by bleeding the pressure off through a vent valve. In the event the gate seals cannot be depressurized, makeup water from a filling pool or transfer canal will overflow the installed gates and fill the other pools and canals.

24. In addition to the ten (10) methods described below, following installation of the plant modifications associated with spent fuel pools C and D, a completely redundant spent fuel pool cooling system, purification system, and skimmer system will be installed in the north end of the fuel handling building. This will provide four (4) additional redundant delivery locations for operators to align existing makeup water sources to the spent fuel pools, transfer canals, and cask loading pool. Procedure OP-116 will be revised to reflect the additional redundant makeup water pathways before adding spent fuel to spent fuel pool C.

Normal Makeup

25. Normal spent fuel pool makeup is accomplished by OP-116, Revision 17, section 8.4, "Makeup to SFP B with Demineralized Water with the Purification System in Service" (Attachment R). To initiate normal makeup, plant operators have to open only a single manual valve, 1SF-201, located on the 216-foot elevation at the south end of the fuel handling building. This action aligns the demineralized water system to the spent fuel purification system and delivers makeup water directly to spent fuel pool B. As described above, makeup is available to spent

fuel pool A (and spent fuel pools C and D when they are placed in service) in the normal bulkhead gate alignment by open communication through the transfer canals and to other pools by either deflating the gate seals or overflowing the gates. The source of water for this mode of makeup is the demineralized water storage tank, which has a capacity of 500,000 gallons. The flow rate is approximately 100 gallons per minute. An operator can reach the valve needed to align this flow path within approximately 15 minutes from any location in the reactor auxiliary building ("RAB") or fuel handling building ("FHB") and can initiate flow within another 5 minutes. The procedural reference for this method is OP-116, Revision 17. Once the SFPCCS for spent fuel pools C and D is placed in service, normal makeup to pools C and D will be initiated by opening a single manual valve, 2SF-201, located on the 216-foot elevation at the north end of the fuel handling building.

Alternate Makeup Method No. 1 – Demineralized Water Tank to Spent Fuel Pool Purification System

26. This method aligns the demineralized water tank to the spent fuel pool purification system and delivers water to spent fuel pool A, spent fuel pool B, the interconnecting transfer canal, the cask loading pool, or all of these locations. To provide makeup water to spent fuel pools A and B, the operators manually opens 1SF-201 and any one of the following valves 1SF-26, -27, -28, -29, or –192. One of these valves is located on the 216 foot elevation of the FHB, two are on the 236 foot elevation of the FHB, and one is on the 261 foot elevation of the FHB. To

align makeup water to the cask loading pool an additional five (5) valves, 1SF-206, 2SF-205, 2SF-141, 188, and 203, are opened. All of these valves are located in the FHB on the 216 foot elevation. After establishing the desired valve lineup, the operator closes power supply breakers 1-4A1021-1D and 1-4B1021-5E for the spent fuel pool purification pumps on the 261-foot elevation of the FHB. Once energized, the operator starts the purification pump from one of two locations (*i.e.*, the FHB operating deck or the FHB 236-foot elevation). The source of water is the demineralized water storage tank with a capacity of 500,000 gallons with a flow rate of approximately 100 gallons per minute. An operator can access these valves within 15 minutes and initiate flow in approximately 30 minutes. The procedural reference for this method is OP-116, Revision 17, section 8.5. When spent fuel pools C and D and the associated SPFCCS are placed in service, a redundant alignment to implement this alternate method will be available by opening 2SF-201 and any one of the following valves, 2SF-26, -27, -28, -29 or -192.

Alternate Makeup Method No. 2 – Refueling Water Storage Tank (RWST) to Spent Fuel Pool Purification System

27. This method aligns the RWST to spent fuel pools A and B, the interconnecting transfer canal, the cask loading pool, or all of these locations simultaneously. To align this flow path, an operator manually shuts 1SF-202 on FHB 216 and opens one or all of the following valves: 1SF-26 or -27 to spent fuel pool A; 1SF-28 or -29 to spent fuel pool B; or 1SF-192 to the south transfer canal. One of these

valves is on the FHB 216 foot elevation and the remainder are on the FHB 236 foot elevation. The operator then opens 1CT-23 on the RAB 236 foot elevation. After establishing the desired valve lineup, the operator closes power supply breakers 1-4A1021-1D and 1-4B1021-5E for the spent fuel pool purification pumps on the FHB 261-foot elevation. Once energized, the operator starts the purification pump from one of two locations (*i.e.*, the FHB operating deck or the FHB 236-foot elevation). The source of this flow path is the RWST with a capacity of 469,000 gallons. If the RWST is approximately 50% or more full, as required during plant operations, this flow path will result in gravity flow to the spent fuel pools, transfer canal, or cask loading pool with an expected flow rate of up to 100 gallons per minute. When spent fuel pools C and D and the associated SFPCCS are placed in service, a redundant method to implement this flow path will be available by aligning 2SF-202, -26, -27, -28, -29, and 192. The Unit 1 RWST will be the source of water through 1CT-23. An operator can access these valves within approximately 15 minutes and initiate flow in approximately 30 minutes. The procedural reference for this method is OP-116, Revision 17, section 8.5.

<u>Alternate Makeup Method No. 3</u> – Demineralized Water System to Spent Fuel Pool Skimmer System

28. This method aligns the demineralized water system to the spent fuel pool skimmer system and delivers makeup water to spent fuel pool A, spent fuel pool B, or the

transfer canal. The method requires the skimmer system to be in service, which is normally the case. To align this flow path, the operator simply opens valve 1DW-527 on the 236-foot elevation of the fuel handling building. The source of water is the demineralized water storage tank with a capacity of 500,000 gallons. The flow rate is approximately 100 gallons per minute. An operator can access this valve and initiate flow in approximately 5 minutes. The procedural reference for this method is OP-116, Revision 17, section 8.6.

Alternate Makeup Method No. 4 – Refueling Water Storage Tank (RWST) to Spent Fuel Pool Cooling System

29. This method aligns the RWST to the suction of the spent fuel pool cooling pumps and delivers water to the spent fuel pool A/B transfer canal, the main fuel transfer canal, or the cask loading pool. To align this flow path the operator manually aligns eleven (11) valves. Eight (8) of the valves, 1SF-1, -5, -9, -10, -21, -23, -24, and -25, are located on the FHB 236-foot elevation; 1SF-193 is located on the FHB 216-foot elevation, and two (2) valves, 3BR-378 and 1CT-23, are located on the RAB 236-foot elevation. The source of water is the RWST with a capacity of 469,000 gallons. If the RWST level is above approximately 50% full (as is required during reactor operation) then the transfer canal or cask loading pool will fill due to gravity with a flow rate of up to approximately 500 gallons per minute. The spent fuel pool cooling pump is then started from the main control room to distribute water to all the pools. An operator can access these valves within approximately 15 minutes and initiate flow in approximately 30 minutes. The

procedural reference for this method is OP-116, Revision 17, section 8.12. When spent fuel pools C and D and the associated SFPCCS are placed in service, a redundant flow path will be available by aligning 2SF-1, -5, -9, -10, -21, -23, -24, -25, and -193. The Unit 1 RWST is the source through valve 1CT-23.

<u>Alternate Makeup Method No. 5</u> – Emergency Service Water (ESW) System to Spent Fuel Pool Cooling System

30. This method aligns the ESW system to the spent fuel pool cooling system. To align this flow path, the operator connects a jumper between spent fuel pool cooling system connection valves, 1SW-1239(269) and 1SF-76, on the RAB 236-foot elevation. A toolbox is staged locally which contains all the necessary hose and fittings to install the jumper. The operator then opens the two valves to initiate flow. The source of water is Harris Lake, which provides a virtually unlimited supply of makeup water at a flow rate is approximately 50 to 75 gallons per minute. The operator can align this flow path within 30 minutes, as all the tools and equipment necessary to align this path are with 50 feet of the valves. The procedural reference for this method is OP-116, Revision 17, section 8.13.

<u>Alternate Makeup Method No. 6</u> – Reactor Makeup Water Storage Tank (RMWST) to Spent Fuel Pool Purification System

31. This method aligns the RMWST to the spent fuel pools. To connect the RMWST to the spent fuel pool purification system, an operator must manually align four (4) valves: 1SF-194 on FHB elevation 216, and 3PM-83, 1PM-81, and 1PM-150 on RAB elevation 261. The source of water is the RMWST with a capacity of

80,000 gallons. The flow rate is 75 to 100 gallons per minute. An operator can access these valves within approximately 15 minutes and initiate flow in approximately 30 minutes. The procedural reference for this method is OP-116, Revision 17, section 8.26.

<u>Alternate Makeup Method No. 7</u> – Fire Protection System to Spent Fuel Pool or Transfer Canals

32. The plant fire protection system draws water from the Harris Lake via a motor driven fire pump or a redundant diesel driven fire pump. There are seven (7) fire hose stations on the operating deck of the fuel handling building, each equipped with a 1 1/2 inch fire hose and connected to a normally pressurized fire water header. Several of these stations, at least one on each level of the building, are seismically qualified. The fire header is maintained pressurized by the fire pump. If the motor driven pump fails, a diesel driven fire pump will automatically start as a backup. To begin filling the spent fuel pools or transfer canal, an operator simply aims a fire hose at the spent fuel pool and opens the hose station valve. Each fire hose can deliver approximately 125 gallons per minute. The fire hoses can be attached to a railing in the fuel handling, precluding the need to station an operator on the fuel handling deck. An operator can access these valves and equipment and initiate flow in approximately 5 minutes.

<u>Alternate Makeup Method No. 8</u> – Normal Water Service ("NSW") System to Spent Fuel Pool or Transfer Canals

33. This method uses water from the NSW system to fill an accessible spent fuel pool

or transfer canal through a hose. The NSW system extends into the waste processing building, where an operator connects a 1-inch drain hose to a NSW system drain valve, 1SW-817, at the FHB 261-foot elevation stair well. Tools and hose can be obtained from the tool room in the service building. The operator then runs approximately 300 feet of hose from the valve to deliver makeup water to spent fuel pool A. A one inch drain hose is expected to provide a flow rate of approximately 50 to 75 gallons per minute. An operator can access these valves and equipment within approximately 45 minutes and initiate flow in approximately another 25 minutes.

Alternate Makeup Method No. 9 – Demineralized Water System to Spent Fuel Pools or Transfer Canals

34. This method provides water from the demineralized water system directly to the spent fuel pools or transfer canals. The west wall of the fuel handling building operating deck contains several service connections for demineralized water designed to connect hoses for use in filling or wash down activities on the fuel handling building operating deck. The demineralized water header is normally pressurized and, by connecting hoses located on the fuel handling building operating deck and opening one (1) header isolation valve, an operator can fill an accessible spent fuel pool or transfer canal at approximately 100 gallons per minute. An operator can access these valves and initiate flow in approximately 5 minutes.

TECHNICAL SUPPORT CENTER (TSC) EMERGENCY MANAGEMENT

35. The TSC is an Emergency Plan facility that is staffed upon declaration of an Alert or higher classification. The Site Emergency Coordinator ("SEC") is the lead position, in charge of coordinating TSC support of main control room response to plant emergencies. The TSC is staffed with representatives from key plant support groups including: operations, radiological control, security, offsite communications, and technical and accident assessment. The TSC is responsible for all on-site emergency response actions. The SEC is trained in the Severe Accident Mitigation Guidelines ("SAMGs"), which provide guidance for beyond design basis events that are not specifically covered in Emergency Operating Procedures. The SEC is in constant communication with the main control room, the operational support center ("OSC") (damage control missions are dispatched from this facility), and the emergency operations facility ("EOF") (coordinates off-site protective actions). The SEC receives important information from the main control room, such as notification of the loss of spent fuel cooling, and coordinates recovery missions with the OSC and control room. The TSC sets the priority for all site missions in response to accident conditions. A significant resource available to the SEC is the Accident Assessment Team, which consists of multi-disciplined, experienced engineers tasked with developing solutions to problems and conditions not specifically addressed in plant procedures.

36. The SAMGs are implemented when core temperatures exceed a pre-determined

value and efforts to restore cooling have been unsuccessful. The SAMGs are designed primarily for the Emergency Response Organization staff to fill the void between the EOPs and Emergency Plan regarding formalized guidance for severe accident situations. The primary goal of the SAMGs is to protect fission product barriers and mitigate any ongoing fission product releases, with a secondary goal to mitigate severe accident phenomena and return the plant to a controlled stable condition.

37. In evaluating an emergency, the TSC staff begins by monitoring a Diagnostic Flow Chart ("DFC") and the Severe Challenge Status Trees which provide guidance to diagnose challenges to fission product barriers. Predetermined values are used to direct implementation of specific SAMGs, which provide a number of solutions to potential challenges to a given barrier. The goals of the SAMGs are to 1) prevent core damage, 2) terminate the progress of core damage if it begins and retain the core in the reactor vessel, 3) maintain containment integrity as long as possible, and 4) minimize offsite releases. Work sheets that provide guidance on a number of mitigation options are included to aid in the development of an implementing strategy. The TSC then evaluates the current equipment capabilities and develops a course of action. The SEC also directs the Accident Assessment Team to develop strategies for the given situation. An analysis of the impacts of the strategies is conducted with the SEC and an strategy is selected and implemented.

CONCLUSIONS

38. There are numerous, diverse methods for providing cooling and makeup water to the Harris spent fuel pools following a loss of normal cooling.

39. Harris operators are trained and capable of performing the actions necessary to initiate one or more of these methods under emergency conditions, although the exact method or methods employed may depend on the specific plant conditions existing at the time. The necessary tools and equipment are available to perform the required actions.

40. Personnel assigned to the Harris TSC are familiar with the SAMGs and are trained to assist plant operators responding to emergency conditions outside of existing emergency response procedures.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 15, 2000.

Eric A. McCartney

Eric A. McCartney

Subscribed and sworn to before me
this 15 day of November 2000.

Darlene S. Yarborough

My Commission expires: 2-21-2005

DARLENE S. YARBOROUGH
NOTARY
***
PUBLIC
HARNETT COUNTY, NC

ERIC A. MCCARTNEY

EXPERIENCE

4/00-Present Carolina Power & Light, Harris Plant New Hill, NC
Supervisor – Licensing/Regulatory Programs

Responsible for managing the regulatory interfaces for the assigned nuclear power plant. Major responsibilities include: managing the NRC regulatory interface including regulatory correspondence and inspections; managing the State of NC regulatory interface including the submission of required regulatory reports; support plant operations by providing interpretations and guidance related to regulatory requirements including participation on the Plant Nuclear Safety Committee and assigned emergency preparedness duties; manage the INPO/plant interface. In addition, duties include the supervision and development of four subordinates and the management of a unit budget of approximately $5 million.

1/99-4/00 Institute of Nuclear Power Operations Atlanta, GA
Operations evaluator

Loaned employee assignment. Qualified Simulator Group Lead and Operations Lead Evaluator. Participated in six INPO evaluation trips, two domestic WANO Peer Reviews, and two assistance visits.

6/97-1/99 Carolina Power & Light, Harris Plant New Hill, NC
Superintendent - Work Control

Senior license holder on site, responsible for directing day-to-day licensed activities. Managed on-line work management process. Developed and implemented daily integrated scheduling for all site activities including modifications on an hourly schedule. Operations representative on Plant Nuclear Safety Committee and Maintenance Rule Panel. Served as Site Emergency Coordinator for plant emergency plan. Served as Shift Operations Manager for outage implementation; completed 35 day outage on schedule.

10/94-6/97 Carolina Power & Light, Harris Plant New Hill, NC
Superintendent - Shift Operations
Managed shift activities including radwaste and make up water systems. Served as Training Program Committee chairman for SRO training program. Implemented operations surveillance testing and managed shift work activities for operators, chemists, and shift Fix-it-Now team. Served as host peer of 1996 INPO evaluation; Harris received INPO 1 and SALP 1.

8/93-10/94 Carolina Power & Light, Harris Plant New Hill, NC
Shift Outage Manager
Developed integrated refueling outage schedule and shutdown risk management process for refueling outage 5. Major evolutions included RTD bypass manifold removal and Auxiliary Feedwater Piping replacement.

1/85-8/93 Carolina Power & Light, Harris Plant New Hill, NC
Plant Operator
Auxiliary operator for hot functional testing and plant startup. Reactor Operator licensed in 1988, Senior Reactor Operator licensed in 1991. Operations procedure writer.

1/78-10/84 U.S. Navy, Submarine Service Charleston, SC
First Class Machinist Mate
Engineering Watch Supervisor, mechanical operator. Qualified diesel generator technician, R-114 air conditioning technician. Responsible for maintaining primary system material history and implementing subsafe quality assurance program.

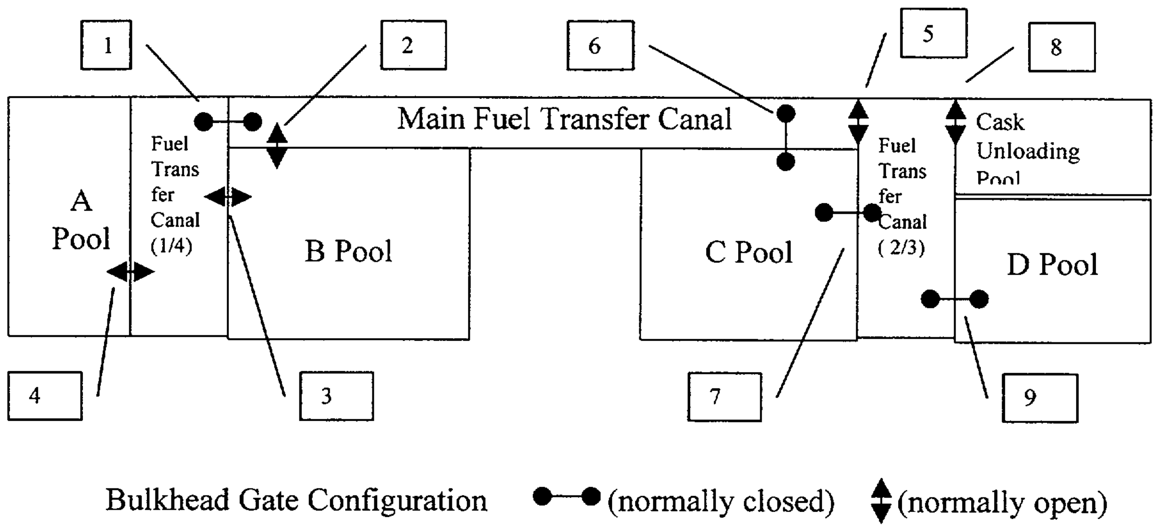
EDUCATION

1989-1995 University of Maryland University College
College Park, MD

- BS, Nuclear Science
- GPA 3.6

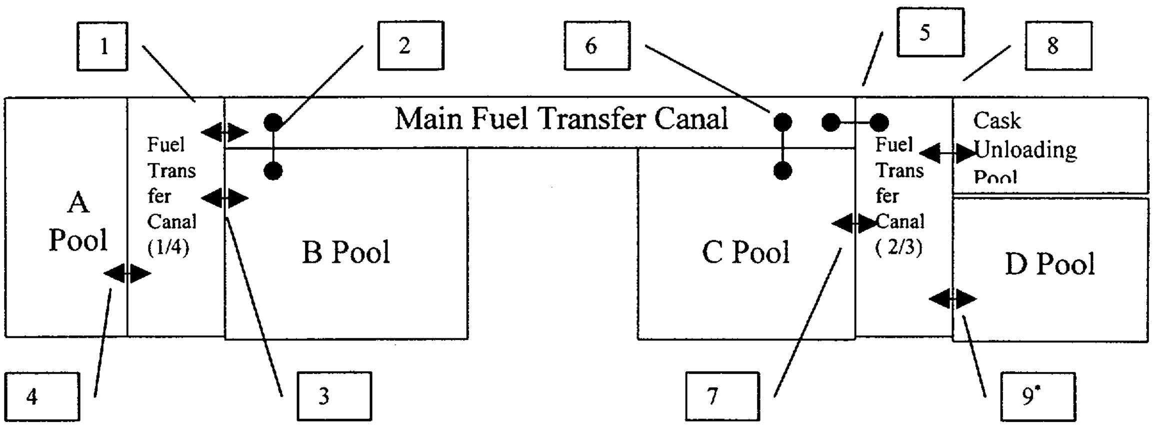
Attachment B

Diagram Illustrating HNP Spent Fuel Storage Pools, Transfer Canals, and Current Bulkhead Gate Configuration.



Attachment C

Diagram illustrating anticipated bulkhead gate configuration in the HNP spent fuel pools subsequent to operational use of C and D pools.



Bulkhead Gate Configuration ●—● (normally closed) ◄► (normally open)

* The "normally open" configuration for gate 9 would apply subsequent to placing this pool in service that is scheduled for early the next decade. Otherwise, this gate would remain normally closed.

I
Information
Use

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description (SD)

NUMBER: SD-116

TITLE: Fuel Pool Cooling and Clean-Up System

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1.0 SYSTEM PURPOSE

The Fuel Pool Cooling and Clean-up System (FPCCS) is designed for the following purposes:

1. To maintain water quality by removing the particulate and dissolved fission and corrosion products resulting from spent fuel in the fuel storage pools and reactor cavity, and;

2. To remove residual heat loads generated by spent fuel stored in the fuel storage pools.

2.0 SYSTEM FUNCTION

2.1 General

The FPCCS maintains water quality in the fuel pools, transfer canals, cask loading pool and the reactor cavity and removes residual heat generated in the stored spent fuel. The FPCCS consists of three subsystems to perform these functions - a cooling system, a cleanup system, and a skimmer system. These systems will be discussed in later sections.

The Fuel Handling Building consists of five main pools. The south end of the FHB consists of New Fuel Pool "A" and Spent Fuel Pool "B". The north end of the FHB consists of Spent Fuel Pool "C", Spent Fuel Pool "D", and the Cask Loading Pool. The five pools are tied to each other by the main transfer canal and the South and North Transfer Canals. The spent fuel is placed in either the "A" or "B" fuel pool during refueling and stored until further disposition. Cooling of spent fuel can be accomplished in either "A" or "B" fuel pool since they are serviced by the fuel pool cooling system. Gates are provided to isolate the five pools and the transfer canals.

Spent Fuel Pools "C" and "D" will not be completed for several years. Consequently, much information is not available for them. The flow paths and mechanical components are discussed but specific electrical and instrumentation information is not.

The fuel pools, the cask loading pool, and transfer canals are furnished with stainless steel liners. The fuel pool liners are constructed to the applicable portions of Section III of the ASME Code. The Fuel Handling Building is designed to Seismic Category I and is tornado missile resistant. Piping in the FPCCS is welded except where flanged connections are used at the pumps, heat exchangers, blind flanges, and control valves to facilitate maintenance. Draining or siphoning of the spent fuel pools via piping or hose connections to these pools and transfer canals is precluded by the location of the penetrations, limitations on hose length and termination of piping penetrations flush with the liner. Control Room and local alarms are provided to alert the operator of abnormal pool level and high temperature. Local water level indication is provided at Spent Fuel Pools "A" and "B".

2.2 Cooling System

(Reference Figures 7.1 through 7.4 for flow diagrams)

The fuel pool cooling system is comprised of two separate systems. Each of these cooling systems consists of fuel pools "A" and "B", south transfer canal, and a cooling loop each with a fuel pool cooling pump, a fuel pool heat exchanger, and a fuel pool strainer. Each of these cooling loops is 100% capacity and independent. The fuel pool cooling pumps are powered from train separated power sources with the capability of being connected to the emergency diesel generator should a loss of offsite power occur.

2.2 Cooling System (continued)

The cooling loops are protected from externally generated missiles and the effects of high and moderate energy fluid piping ruptures.

The fuel pool cooling water return piping terminates at elevation 279'6". The spent fuel pool suction piping exits at 278'6" and the new fuel pool suction piping exits at 277'6". Normal water level in the pool is 284'6" with the top of the spent fuel racks at approximately 260.08'. This design thus precludes uncovering the fuel as a result of a suction line rupture since approximately 18' of water is over the fuel at all times. The location of the cooling inlet and outlet connections to the fuel pools preclude the possibility of coolant flow short circuiting the pool. If, due to a gross valve misalignment, one pool was aligned to the suction of both fuel pools cooling water pumps with no makeup the pumps would loose suction in approximately 7.5 minutes for the spent fuel pools "B" and "C", 2.7 minutes for new fuel pool "A", and 3.5 minutes for spent fuel pool "D".

Normal makeup for evaporative losses and small amounts of system leakage from the fuel pools is accomplished using the Demineralized Water System (DWS), although other sources, such as from the reactor makeup water storage tank or the recycle holdup tank, may also be used.. The DWS connects to the fuel pools and refueling water purification pumps, spent fuel pools cooling pumps, and fuel pools skimmer pumps to permit makeup to the fuel pools, or may be directly added to the pools via hoses. The seismic category I refueling water storage tank (RWST) may also be aligned to provide borated makeup water to the fuel pools, and a seismic category I source of emergency makeup water is available from the emergency service water (ESW) system, by connecting flexible hoses to connections on the ESW and fuel pool cooling and cleanup system piping.

In the event of a single failure in one spent fuel pool cooling loop, the other loop will provide adequate cooling. The concrete forming the pools is designed for 150 degrees F, however, HVAC considerations make 137 degrees F the upper allowable pool temperature. A low flow alarm is provided to warn of interruption of cooling.

2.3 Cleanup System

(Reference Figures 7.5 through 7.7 for flow diagram)

The fuel pool cleanup system is comprised of two separate systems. Each of the cleanup systems consists of a fuel pool demineralizer, a fuel pool demineralizer filter, a fuel pool and refueling water purification filter, and two fuel pool purification pumps. The cleanup system is not safety related nor is it designed to seismic Category I requirements. Valving is provided between the cooling system and cleanup system to permit isolation of this non safety related system.

The fuel pool cleanup system can be used to maintain the purity and clarity of fuel pool water by diverting approximately 6% of the cooling system flow through the cleanup system. The clean-up loop can also take a suction from the refueling cavity at elevation 246.00 ft. and clean the refueling water through the demineralizer and discharge back to the refueling cavity at elevation 285.00 ft. This is done, independently of the cooling loop. The cleanup system is also used to purify the reactor coolant drain tank heat exchanger effluent prior to discharging into the recycle holdup tank, to purify the contents of the RWST, and to drain and purify the reactor cavity.

2.4 Skimmer System

(Reference Figures 7.8 and 7.9 for flow diagram)

The fuel pool skimmer system consists of a skimmer pump, a fuel pool skimmer strainer, and a fuel pool skimmer filter. The skimmer system removes any floating debris from the surface of the various pools. Skimmers may be dispersed as follows:

Pool A:	3
Pool B:	5
South Transfer Canal:	2
Main Transfer Canal:	1
North Transfer Canal:	2
Cask Loading Pool:	1

3.0 COMPONENTS

3.1 Major System Components

(Reference Table 6.2 for Component Design Parameters and Table 6.3 for Electrical Power Supplies of applicable components)

The Fuel Pool Cooling and Clean-up System is comprised of the following components:

1. Fuel Pool Heat Exchanger

   Two fuel pool heat exchangers are provided (1&4A-SA and 1&4B-SB). The fuel pool heat exchangers are of the shell and straight tube type. Component cooling water supplied from the RAB Component Cooling Water System circulates through the shell, while fuel pool water circulates through the tubes. The installation of two heat exchangers assures that the heat removal capacity of the cooling system is only partially lost if one heat exchanger fails or becomes inoperative. The exchangers are located on elevation 236 of the FHB.

2. Fuel Pool Demineralizer

   The demineralizer (1&4X-NNS) is sized to pass approximately six percent of the cooling loop circulation flow to provide adequate purification of the fuel pool water and to maintain optical clarity in the pool. The demineralizer also cleans refueling cavity water by passing a maximum of 260 gpm through the demineralizer. The demineralizer is located on elevation 261 of the FHB, south end.

3. Fuel Pool Cooling Pump

   Two 4560 gpm horizontal centrifugal pumps are installed (1&4A-SA and 1&4B-SB). The use of two pumps installed in separate lines assures that pumping capacity is only partially lost should one pump become inoperative. This also allows maintenance on one pump while the other is in operation. The pumps are located on elevation 236 of the FHB, west of the heat exchangers.

3.1 Major System Components (continued)

4. Filters (Fuel Pool Demineralizer Filter, Fuel Pool and Refueling Water Purification Filter, and Skimmer Filter)

   Three filters are installed; Fuel Pool Demineralizer Filter - 1&4X, Fuel Pool and Refueling Water Purification Filter 1&4X, and Skimmer Filter 1&4X. These filters remove particulate matter from the fuel pool water and are cleaned by the backwash system.

5. Fuel Pool Cooling and Cleanup System Skimmers

   Fourteen skimmers are available for use; five for spent fuel pool "B", one for the main fuel transfer canal, one for the cask loading pool, three for new fuel pool "A", and two each for the south and north transfer canals.

6. Fuel Pool Skimmer Pump

   The 385 gpm fuel pool skimmer pump 1&4X-NNS takes suction from the selected surface floating skimmers and discharges through a filter to the selected pools/canals.

7. Fuel Pool and Refueling Water Purification Pump

   Two 325 gpm fuel pool and refueling water purification pumps are provided (1&4A-NNS and 1&4B-NNS). Each pump can take suction from and return fluid to the refueling water storage tank via Containment Spray System lines, the transfer canals, the new and spent fuel pools, the refueling cavity, or the cask loading pool. Fluids from these systems are purified by the fuel pool demineralizer and filter. Each pump can also take suction from the demineralized water system for line flushing. The pumps are located on elevation 216 of the FHB, south end.

8. Fuel Pool Cooling and Cleanup System Valves

   Manual butterfly valves are used to isolate equipment and lines and throttle valves provide flow control. Valves in contact with fuel pool water are of austenitic stainless steel or of equivalent corrosion resistant material.

9. Fuel Pool Cooling and Cleanup System Piping

   All piping in contact with fuel pool water is of austenitic stainless steel construction. The piping is welded except where flanged connections are used at the pumps, heat exchangers, blind flanges, and control valves to facilitate maintenance.

10. Fuel Pool Gates

   The vertical steel gates with inflatable rubber seals, on the new fuel pools, spent fuel pools, fuel transfer canals, main transfer canal, and cask loading pool allow the spent fuel to be immersed at all times while being transferred without the necessity of filling all pools and canals. They also allow each area to be isolated for draining, if necessary. The pool gates are moved about by the 10-ton auxiliary crane and stored in a storage area in the main transfer canal.

3.1 Major System Components (continued)

11. Fuel Pool Skimmer Pump Suction Strainer

One duplex basket strainer is installed in the suction piping to the Fuel Pool Skimmer Pump. Large particles and debris are collected on the 100 mesh strainer baskets. One side of the strainer may be in operation while the other side is idle or under maintenance.

12. Fuel Pool Strainer

One simplex basket strainer is installed in the suction piping to each Spent Fuel Pool Cooling Pump. The strainer basket is a 40 mesh basket.

3.2 Instrumentation and Control

Each FPCCS has physically and electrically separate and independent instrumentation and controls.

CAUTION

Setpoints are for information only. The official set point document is Ebasco Drawing CAR 2166-B-508.

---

1. Instrumentation

a. FT-5100 (A and B)

These flow transmitters measure flow rate into New Fuel Pool "A" from the fuel pool cooling pumps with a signal to annunciators for low flow on panel F-P9 in the Fuel Handling Building (FHB) and ALB-23, 5-19, in the Main Control Room.

b. TE-5100 (A and B)

These temperature elements measure temperature of New Fuel Pool "A" water with a signal to annunciator panel ALB-23, 5-16 for high new fuel pool temperature. Monitor light boxes are provided to indicate operational status.

c. LS-5100 (A and B)

These level switches measure the level of New Fuel Pool "A" and compare the measured level to the normal water level of 284.50 ft. These annunciators are mounted on ALB-23, 5-18 and Panel F-P9 in the FHB. Monitor Light Boxes are provided for indication of operational status. Annunciators for levels are as follows: high level - 284.75 ft., lo level - 284.00 ft., lo-lo level - 282.00 ft.

d. FT-5110 (A and B)

These flow transmitters measure flowrate into Spent Fuel Pool "B" from the fuel pool cooling pumps with a signal to local indicators and annunciators for low flow on panel F-P9 in the FHB and ALB-23, 4-19.

3.2 Instrumentation and Control (continued)

e. TE-5110 (A and B)

These temperature elements measure temperature of the Spent Fuel Pool "B" water with a signal to an annunciator ALB-23, 4-16 for high pool temperature. Monitor Light Boxes are provided to indicate operational status.

f. LS-5110 (A and B)

These level switches measure the level of Spent Fuel Pool "B" and compare the measured level to the normal water level of 284.50 ft. These annunciators are mounted on ALB-23, 4-18 and panel F-P9 and in the FHB. Monitor Light Boxes are provided to indicate operational status. Level annunciators are as follows: Hi level - 284.75 ft., lo level - 284.00 ft., lo-lo level 282.00 ft.

g. PDT-5112

This pressure transmitter measures the differential pressure across the fuel pool skimmer filter with a signal sent to the Filter Backwash System for indication of need for filter cleaning.

h. PI-5111

This pressure indicator measures the discharge pressure from the fuel pool skimmer pump with local indication.

i. PDS-5109

This differential pressure switch measures the differential pressure across the fuel pool skimmer pump suction strainer and sends a signal to the Filter Backwash System for indication of need for strainer cleaning.

j. PDS-5130 (A and B)

These differential pressure switches measure the difference in pressure across the fuel pool cooling pump strainers, indicate differential pressure at local instrument rack F-R7, and alarms an annunciator mounted on panel F-P7 at high differential pressure.

k. PI-5130 (A and B)

These pressure indicators are locally mounted on the cooling pump discharge headers.

l. PT-5140 (A and B)

These pressure transmitters supply cooling pump discharge header pressure signals to the PIC Cabinets where a pressure switch alarms annunciators mounted on panel F-P7 for header low pressure.

3.2 Instrumentation and Control (continued)

m. PDS-5150

This differential pressure switch measures the differential pressure across the fuel pool demineralizers with indication locally mounted and an annunciator on panel F-P7.

n. PDT-5152 (A and B)

These differential pressure transmitters measure the differential pressure across the fuel pool and refueling water purification filter and the fuel pool demineralizer filter. The signal is fed to the Filter Backwash System for indication of need for filter cleaning.

o. FT-5154 (A and B)

These flow transmitter measure the flow rate of fuel pool filters discharge flow with a signal to an annunciator and indication on panel F-P7. An interlock allows purification pump startup and shutdown without annunciation.

p. TE-5160 (A and B)

These temperature elements measure inlet temperature of fuel pool water to the cooling loop heat exchangers. A local indication is given and annunciators alarm on panel F-P7 for high temperature.

q. TE-5170 (A and B)

These temperature elements measure outlet temperature of the fuel pool water from the cooling loop heat exchangers. On high temperature, an annunciator alarms on panels F-P9 and F-P7 in the FHB. Local indication is given on panel F-P7.

r. PI-5190 (A and B)

These pressure indicators measure the fuel pool and refueling water purification pumps discharge pressure and gives a local indication.

s. PS-5190 (A and B)

These pressure switches measure the fuel pool and refueling water purification pump discharge pressure and on low discharge pressure alarms an annunciator on panel F-P7 in the FHB. This switch is interlocked with the purification pump to allow for pump startup and shutdown without annunciation.

2. System Controls

a. Fuel Pool Cooling Pumps

Start-Stop controls and indication lights are provided for the fuel pool cooling pumps on the Auxiliary Equipment Panel (AEP #1) in the Main Control Room. Indication lights are also provided on panels F-P7 and F-P9. The pumps are sequenced off during a loss of offsite power event, but may be manually restarted.

3.2 Instrumentation and Control (continued)

b. Fuel Pool and Refueling Water Purification Pumps

Start-Stop controls and indication lights for the fuel pool and refueling water purification pumps are provided on panels F-P7, and F-P9. All panels are located in the FHB. Annunciators for pump overload are provided on panel F-P9.

c. Fuel Pool and Refueling Water Purification Filters and Fuel Pool Demineralizer Filters

Filter Backwash System Isolation Valves 1SF-134, 1SF-135, 1SF-124, and 1SF-125

Open-shut controls are provided to isolate the filters from FPCCS piping for cleaning through the filter backwash system. These controls are located in the Waste Processing Control Room on the BOP B/F Auxiliary Control Panel.

d. Fuel Pool Skimmer Filters

Isolation Valves (1SF-86, 1SF-85)

Open-shut controls are provided to isolate the filters from FPCCS piping for cleaning through the filter backwash system. These controls are located in the Waste Processing Control Room on the BOP B/F Auxiliary Control Panel.

e. Fuel Pool Skimmer Pumps

Start-stop controls and indication lights are provided on panel F-P7 and F-P9. All panels are located in the FHB. Annunciators for pump overload are provided on panel F-P9.

4.0 OPERATIONS

The FPCCS is manually controlled and may be shutdown safely for reasonable lengths of time for maintenance or replacement of malfunctioning components. The clean-up loop is normally run on an intermittent basis as required by chemistry analysis of fuel pool water conditions. It is possible to operate the clean-up loop with the demineralizer bypassed. Local samples are taken to permit analysis of demineralizer or filter efficiencies.

The operator may control the fuel pool cooling pumps from main control board only, with indication lights on panels F-P7 and F-P9. FPCCS valves must be manually aligned to take suction from the following locations for various modes of FPCCS operation:

1. Refueling Cavity - The clean-up loop is available for refueling water clean-up and draining through the filter and demineralizer during refueling operations.

2. RWST - The clean-up loop and cooling loop is available to take suction from the RWST and fill transfer canals and fuel pools.

3. North and South Transfer Canals - The clean-up loop is available to drain and clean water in the north and south transfer canals.

4.0 OPERATIONS (continued)

4. Reactor Coolant Drain Tank - The clean-up loop is available to filter and purify water through the demineralizer and filters.

5. Fuel Pools - The cooling loop is available to cool the fuel pool water and send water to the clean-up loop for purification.

6. Cask Loading Pool - The clean-up loop is used to fill and purify the cask loading pool.

7. Main Transfer Canal - The clean-up loop is available to drain and clean water on the main transfer canal.

8. Reactor Make-up Water Storage Tank - The cleanup loop is available to take suction from the RMWST and fill the transfer canals and fuel pools.

FPCCS valves may also be aligned to discharge to the following locations:

1. Refueling Cavity - The clean-up loop discharges to the refueling cavity during refueling operations.

2. RWST - Water can be pumped back to the RWST through the clean-up loop.

3. Boron Recycle Holdup Tank - The clean-up loop provides a path to the Boron Recycle System Holdup Tanks to store water from the transfer canal during fuel transfer system maintenance or recycle refueling water.

4. Fuel Pools - Cooled and cleaned fuel pool water is discharged to the fuel pools through cooling piping.

5. North and South Transfer Canals - The clean-up loop and cooling loop provide a path to fill the north and south transfer canals.

6. Cask Loading Pool - The clean-up loop provides a path to fill and purify the cask loading pool.

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

1. Waste Processing System

The Filter Backwash System (FBWS) allows cleaning of the following filters:

a. Fuel Pool and Refueling Water Purification Filters

b. Fuel Pool Demineralizer Filters

c. Fuel Pool Skimmer Filters

In association with the FBWS, the Demineralized Water System, and the Nitrogen System are required to clean the above filters. The spent resin in the fuel pool demineralizer is pumped to the Waste Processing System spent resin header. Controls for isolation valves on the filters and demineralizer are on the Waste Processing System Control Board.

5.1 Systems Required for Support (continued)

2. Component Cooling Water

The Component Cooling Water System provides the heat sink for the fuel pool heat exchangers.

3. Demineralized Water

The Demineralized Water System provides make-up water for the fuel pools and canals by connection to the suction header of the Fuel Pool Purification Pumps. The Demineralized Water System provides priming water for the pool skimmers by connection to the suction piping of the Fuel Pool Skimmer Pump.

5.2 System to System Cross-ties

1. Waste Processing System

The reactor coolant drain tank pumps can transfer reactor coolant from the reactor coolant drain tank to the fuel pool and refueling water purification pumps through the fuel pool demineralizer filter and the demineralizer to the RWST or Boron Recycle holdup tank.

2. Boron Recycle System

The FPCCS purification loop has the capability of transferring borated water from the fuel pools, cask loading pool, transfer canals, refueling cavity, or reactor coolant drain tank to the Boron Recycle System recycle holdup tank.

3. Chemical and Volume Control System

For emergency purposes, CVCS supplies borated water to FPCCS through emergency connections.

4. Containment Spray System

The FPCCS can either take suction from or discharge to the RWST for filling or draining transfer canals and filling pools.

5. Primary Make-up System

The FPCCS can take suction from the RMWST for filling transfer canals and fuel pools.

6.0 TABLES

Table 6.1 - Fuel Pool Heat Load, Equilibrium Temperature, and Heat Inertia

Table 6.2 - Component Design Parameters

Table 6.3 - Fuel Pool Cooling and Clean-Up System Electrical Power Supply

Table 6.1
Fuel Pool Heat Load, Equilibrium Temperature, and Heat Inertia[1]

Fuel Pool Heat Load	
Incore Shuffle	16.84×10^6 Btu/hr
Full Core Offload Shuffle	35.06×10^6 Btu/hr
Post Outage Full Core Offload	35.87×10^6 Btu/hr
Fuel Pool Equilibrium Temperature[2]	
Incore Shuffle	≤137 °F
Full Core Offload Shuffle	≤137 °F
Post Outage Full Core Offload	≤137 °F
Combined Spent and New Fuel Pool Heat Inertia	
Incore Shuffle	4.37 °F/hr
Full Core Offload Shuffle	9.09 °F/hr
Post Outage Full Core Offload	9.30 °F/hr

Notes

1. Based on operation through the end of cycle 10 with the bounding heat load from post RFO-9 plus additional spent fuel shipments.

2. Administrative controls placed on the minimum cooling time prior to the transfer of irradiated fuel from the core to the storage facility to maintain the pools at less than or equal to 137 °F.

Table 6.2
Component Design Parameters

Fuel Pool Heat Exchanger	
Quantity	2
Type	Shell & tube, two pass
UA (per Heat Exchanger) Btu/hr-°F	21.1×10^5
Manufacturer	Yuba Heat Transfer Corp.
Heat Transfer Rate (Btu/hr)	1.506×10^6
Shell Side (Component Cooling Water)	
Inlet temperature, °F	105
Outlet temperature, °F	110.62
Design flowrate, lbm/hr	2.68×10^6
Design pressure, psig	150
Design temperature, °F	200
Material	Carbon Steel
Tube Side (Fuel Pool Water)	
Inlet temperature, °F	120
Outlet temperature, °F	112
Design flowrate, lbm/hr	1.88×10^6
Design pressure, psig	150
Design temperature, °F	200
Material	Stainless Steel
Fuel Pool Cooling Pump	
Quantity	2
Type	Horizontal, centrifugal
Design flowrate, gpm	4560
TDH, ft. water	98.2
Motor horsepower	150
Design pressure, psig	150
Design temperature, °F	200
Material	Stainless Steel
New Fuel Pool (Pool A)	
Volume, gallons at El. 284.5'	142,272
Boron concentration, minimum, ppm	2,000
Liner material	Stainless Steel
Spent Fuel Pool (Pool B)	
Volume, gallons at El. 284.5'	388,800
Boron concentration, minimum, ppm	2,000
Liner material	Stainless Steel
Fuel Pool Demineralizer Filter	
Quantity	1
Type	Back Flushable
Design pressure, psig	400
Design temperature, °F	200
Design flowrate, gpm	325
Maximum dp clean, psi	5
Maximum dp dirty, psi	60
Filter rating, microns	5
Filter type	Stacked, etched disks

Table 6.2

Fuel Pool Demineralizer	
Quantity	1
Resin type	Mixed bed (1:1, cation: anion)
Resin volume, cubic feet	85
Design pressure, psig	400
Design temperature, °F	200
Design flowrate, gpm	325
Maximum dp clean, psi	10
Maximum dp dirty, psi	25
Fuel Pool and Refueling Water Purification Filter	
Quantity	1
Type	Back Flushable
Design pressure, psig	400
Design temperature, °F	200
Design flowrate, gpm	325
Maximum dp clean, psi	5
Maximum dp dirty, psi	60
Filter rating, microns	5
Filter type	Stacked, etched disks
Fuel Pool Strainer	
Quantity	2
Type	Single Basket
Design pressure, psig	150
Design temperature, °F	200
Design flowrate, gpm	4560
Maximum dp at design flowrate, psi	1.4
Mesh size	40
Fuel Pool Skimmer Pump Suction Strainer	
Quantity	1
Type	Duplex Basket
Design pressure, psig	150
Design temperature, °F	200
Design flowrate, gpm	385
Maximum dp at design flowrate, clean, psi	5
Mesh size	100
Fuel Pool Skimmer Filter	
Quantity	1
Type	Back Flushable
Design pressure, psig	400
Design temperature, °F	200
Design flowrate, gpm	400
Maximum dp clean, psi	5
Maximum dp dirty, psi	60
Filter rating, microns	5
Filter type	Stacked, etched disks

Table 6.2

Fuel Pool Skimmer Pump		
Quantity		1
Type		Horizontal, centrifugal
Design flowrate, gpm		385
TDH, ft. water		210
Motor horsepower		40
Design pressure, psig		150
Design temperature, °F		200
Material		Stainless Steel
Fuel Pool and Refueling Water Purification Pump		
Quantity		2
Type		Vertical In line centrifugal
Design flowrate, gpm		325
TDH, ft. water		320
Motor horsepower		60
Design pressure, psig		150
Design temperature, °F		200
Material		Stainless Steel
Fuel Pool Skimmer Connections	Quantity	GPM Rating Each
Spent Fuel Pool (Pool B)	5	35
New Fuel Pool (Pool A)	3	30
North Transfer Canal	2	25
South Transfer Canal	2	25
Main Transfer Canal	1	20
Cask Loading Pool	1	50

Table 6.3
Fuel Pool Cooling and Clean-Up System
Electrical Power Supply

1. 480 VAC Motor Control Centers

LOAD	MCC#
Fuel Pool Cooling Pump 1A-SA	1A33-SA COMPT 4D
Fuel Pool Cooling Pump 1B-SB	1B33-SB COMPT 2D
Fuel Pool & Refueling Water Purification Pump 1A-NNS	1-4A1021 COMPT 1D
Fuel Pool Skimmer Pump 1X-NNS	1-4A1021 COMPT 5E
Fuel Pool & Refueling Water Purification Pump 1B-NNS	1-4B1021 COMPT 5E

2. 125 VDC Power Panels

LOAD	DISTRIBUTION PANEL #
New Fuel Pool Level Annunciation Relays for LS-5100A(SA)	DP-1ASA CKT#15
New Fuel Pool Level Annunciation Relays for LS-5100B(SB)	DP-1BSB CKT#22
Cooling Pump 1A-SA Annunciation Relay for Low Disch Pressure, PS-5140A	DP-1A-2 CKT#30
Cooling Pump 1B-SB Annunciation Relay for Low Disch Pressure, PS-5140B	DP-1A-2 CKT#30
Spent Fuel Pool Temp Annunciation Relay for TS-5110A(SA)	DP-1ASA CKT#15
Spent Fuel Pool Temp Annunciation Relay for TS-5110B(SB)	DP-1BSB CKT#22
Spent Fuel Pool Level Annunciation Relay for LS-5110A(SA)	DP-1ASA CKT#15
Spent Fuel Pool Level Annunciation Relay for LS-5110B(SB)	DP-1BSB CKT#22
New Fuel Pool Temp Annunciation Relay for TS-5100A(SA)	DP-1ASA CKT#15
New Fuel Pool Temp Annunciation Relay for TS-5100B(SB)	DP-1BSB CKT#22
Fuel Pool Purification Pump 1A-NNS Space Heater	PP1-4A 10221 CKT #8
Fuel Pool Purification Pump 1B-NNS Space Heater	PP1-4B 10212 CKT #2
Fuel Pool Cooling Pump 1A-SA Space Heater	PP 1A 33-SA CKT #1
Fuel Pool Cooling Pump 1B-SB Space Heater	PP 1B 33-SB CKT #1
Local Control Panel F-P9	PP 1-4A10221 CKT #9
Local Control Panel F-P7	PP 1-4A111 CKT #27

7.0 FIGURES

Figure 7.1 - Fuel Pool Cooling System

Figure 7.2 - Fuel Pool Cooling System

Figure 7.3 - Fuel Pool Cooling System

Figure 7.4 - Fuel Pool Cooling System

Figure 7.5 - Fuel Pools Cleanup System

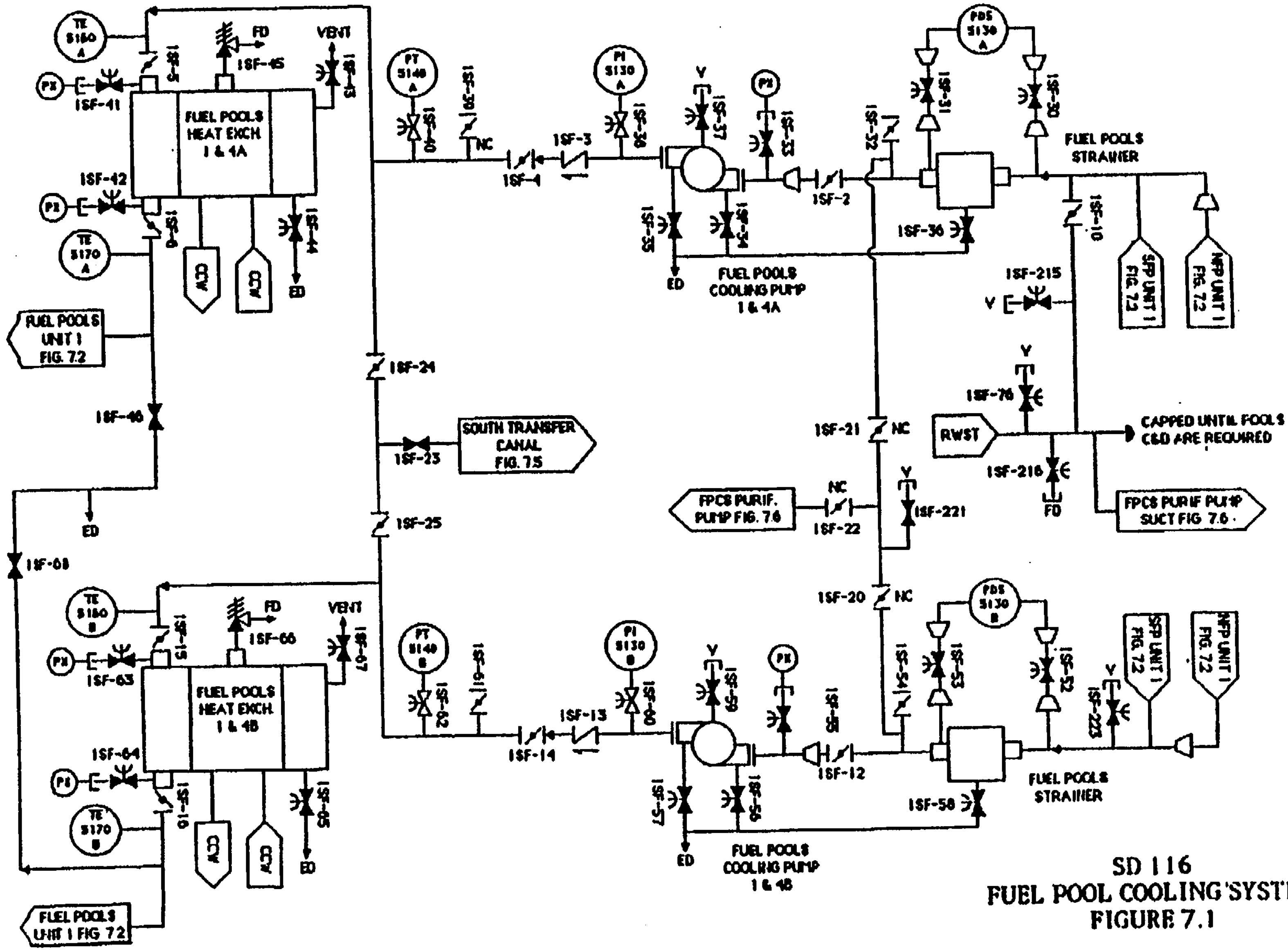
Figure 7.6 - Fuel Pools Cleanup System

Figure 7.7 - Fuel Pools Cleanup System

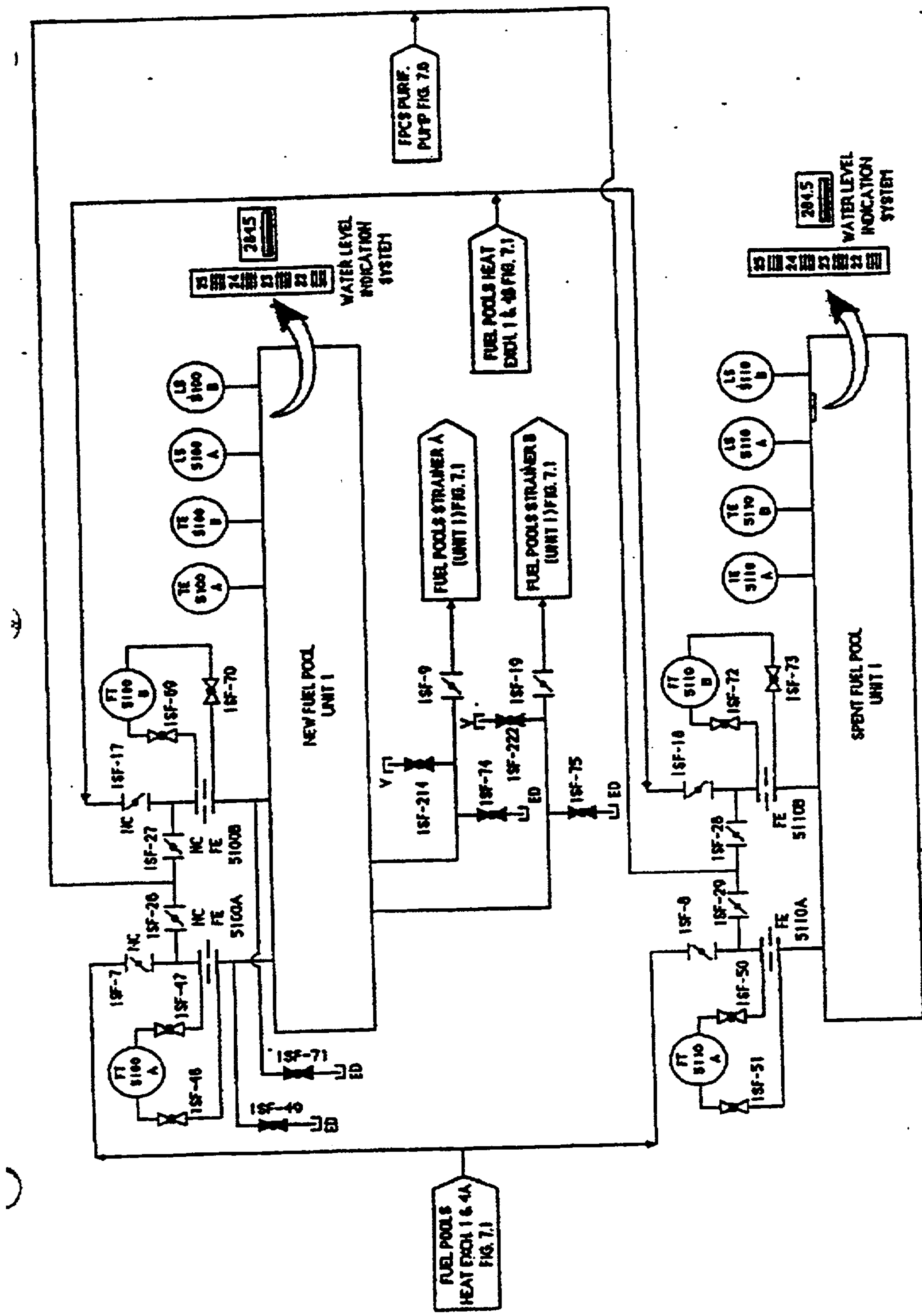
Figure 7.8 - Fuel Pools Cleanup System

Figure 7.9 - Fuel Pools Cleanup System

Figure 7.10 - Fuel Pool Layout Plan



SD 116
FUEL POOL COOLING SYSTEM
FIGURE 7.1



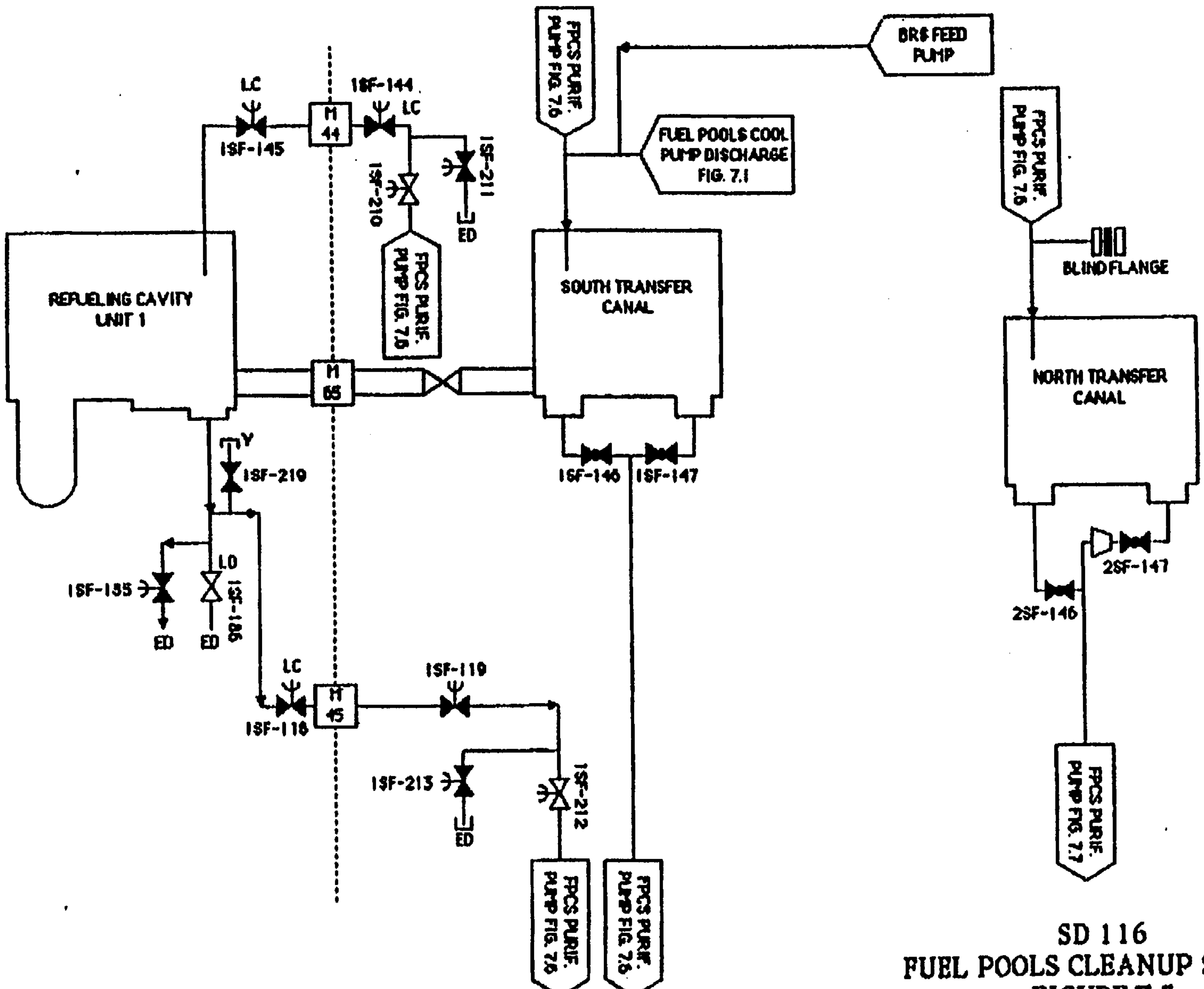
SD 116
FUEL POOL COOLING SYSTEM
FIGURE 7.2

UNIT 2 AND 3 FUEL POOL COOLING
SYSTEM CURRENTLY NOT INSTALLED

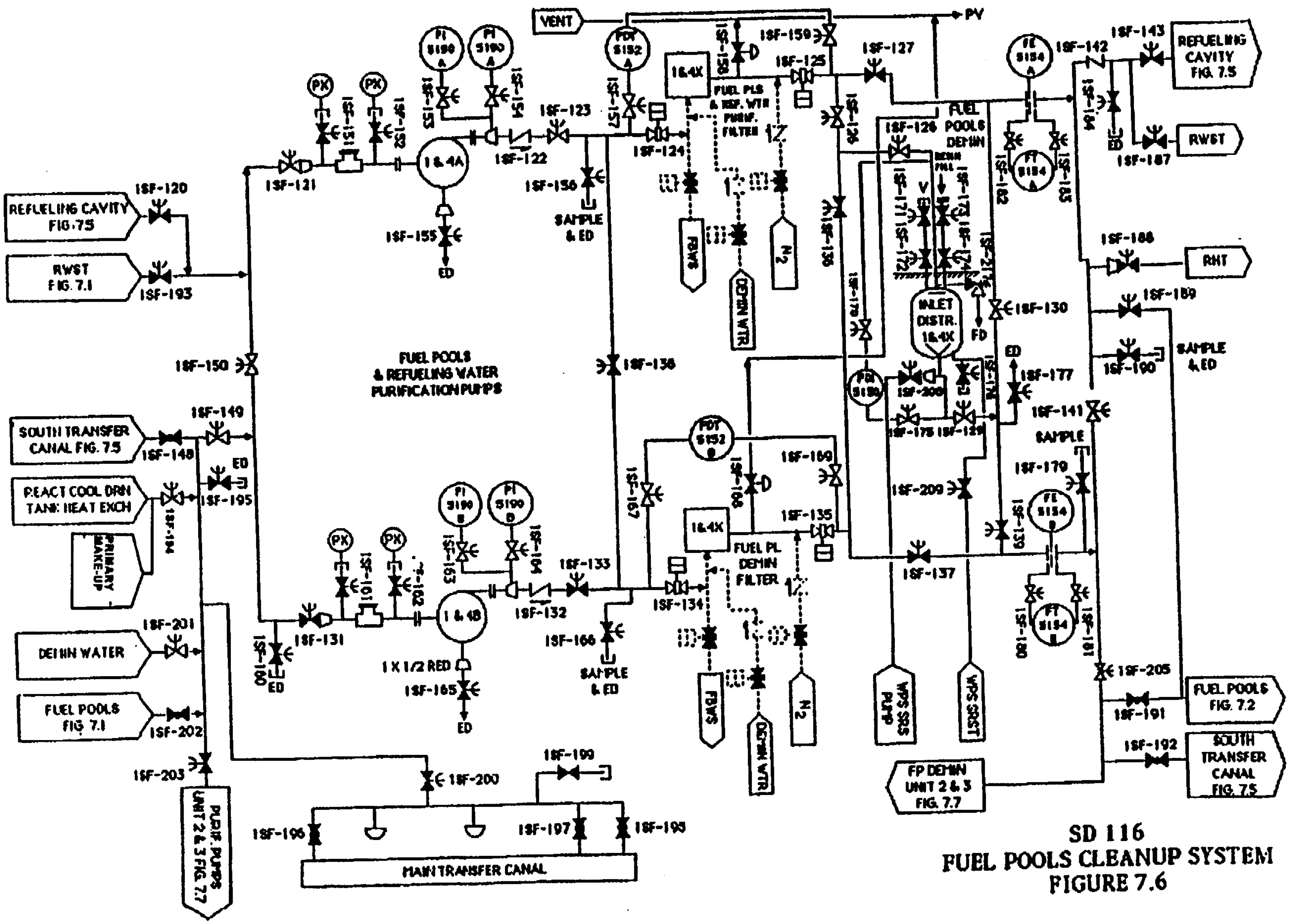
SD 116
FUEL POOL COOLING SYSTEM
FIGURE 7.3

UNIT 2 AND 3 FUEL POOL COOLING
SYSTEM CURRENTLY NOT INSTALLED

SD 116
FUEL POOL COOLING SYSTEM
FIGURE 7.4

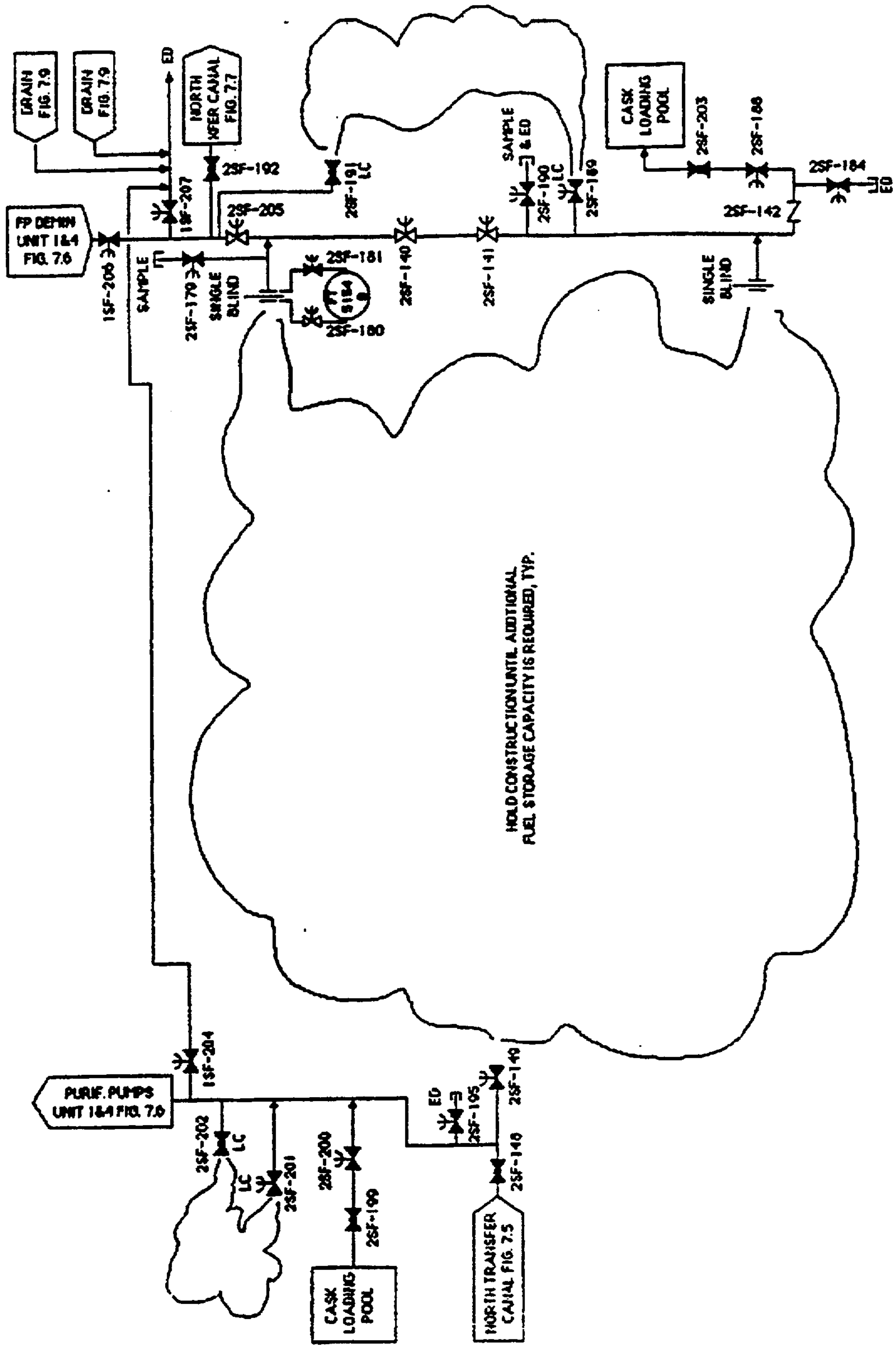


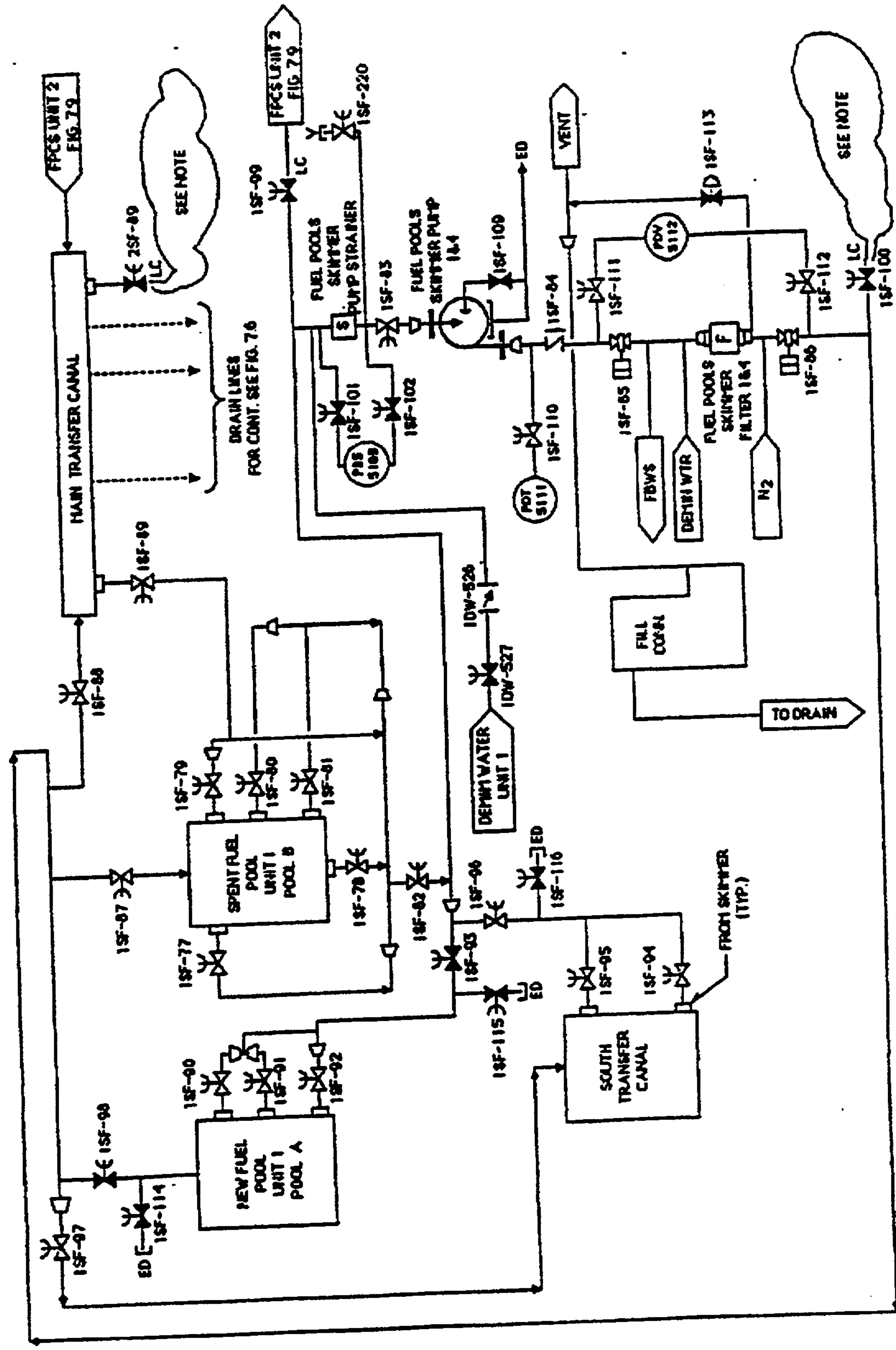
SD 116
FUEL POOLS CLEANUP SYSTEM
FIGURE 7.5



SD 116
FUEL POOLS CLEANUP SYSTEM
FIGURE 7.6

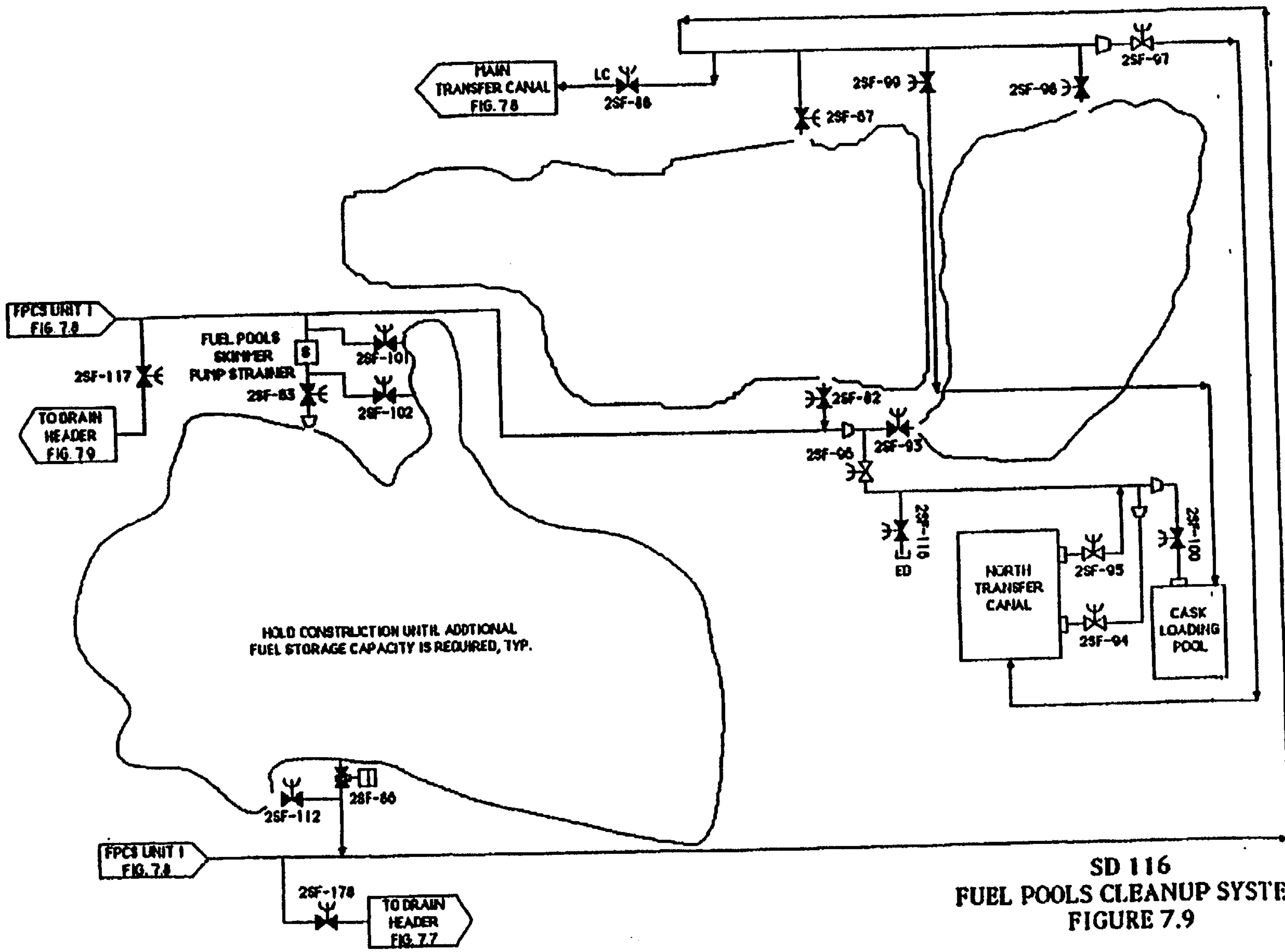
SD 116
FUEL POOLS CLEANUP SYSTEM
FIGURE 7.7



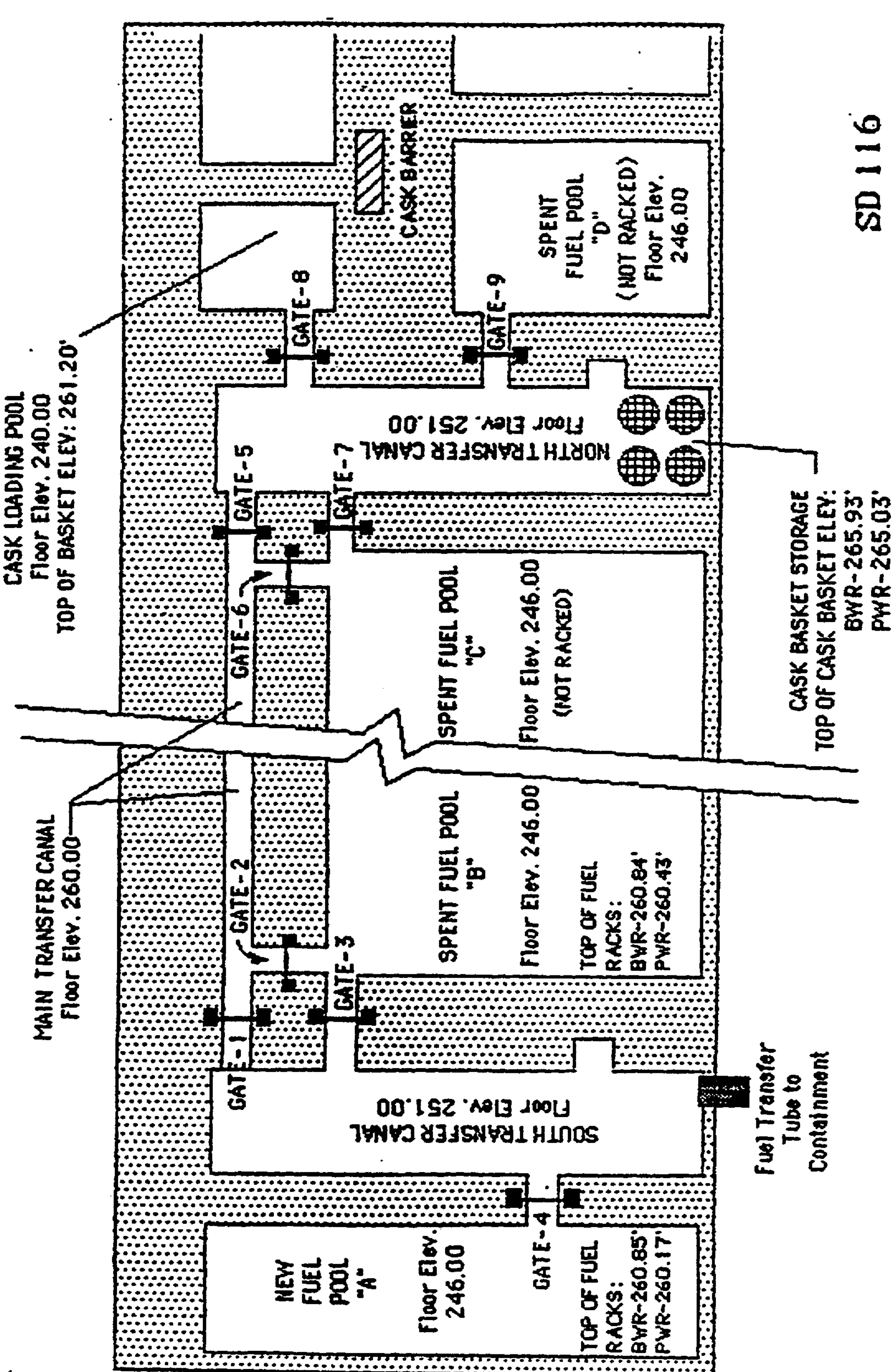


SD 116
FUEL POOLS CLEANUP SYSTEM
FIGURE 7.8

NOTE: HOLD CONSTRUCTION UNTIL ADDITIONAL FUEL STORAGE FUEL STORAGE CAPACITY IS REQUIRED.



SD 116
FUEL POOLS CLEANUP SYSTEM
FIGURE 7.9



SD 116
FUEL POOLS LAYOUT PLAN
Figure 7.10

8.0 REFERENCES

8.1 Drawings

1. Flow Diagrams

   CAR-2165-G-061, Flow Diagram Fuel Pools Cleanup Systems, Sheet 1, Units 1, 2, 3, and 4

   CAR-2165-G-062, Flow Diagram Fuel Pools Cleanup Systems, Sheet 2, Units 1, 2, 3, and 4

   CAR-2165-G-305, Flow Diagram Fuel Pools Cooling System, Units 1 and 4

2. Control Wiring Diagrams

   CAR-2166-B-401, Sheet 881, Fuel Pool Cooling Pump Heat Exchanger 1 & 4A-SA Instrumentation

   CAR-2166-B-401, Sheet 882, Fuel Pool Cooling Pump Heat Exchanger 1 & 4B-SB Instrumentation

   CAR-2166-B-401, Sheet 883, Spent Fuel Pool Instrumentation

   CAR-2166-B-401, Sheet 884, Spent Fuel Pool Water Level Alarm and Indication, Sheet 1

   CAR-2166-B-401, Sheet 885, Spent Fuel Pool Water Level Alarm and Indication, Sheet 2

   CAR-2166-B-401, Sheet 886, Spent Fuel Pool Water Level Alarm and Indication, Sheet 3

   CAR-2166-B-401, Sheet 887, New Fuel Pool Instrumentation

   CAR-2166-B-401, Sheet 888, New Fuel Pool Water Level Alarm and Indication, Sheet 1

   CAR-2166-B-401, Sheet 889, New Fuel Pool Water Level Alarm and Indication, Sheet 2

   CAR-2166-B-401, Sheet 890, New Fuel Pool Water Level Alarm and Indication, Sheet 3

   CAR-2166-B-401, Sheet 891, Fuel Pools and Refueling Water Purification Pump 1 & 4A-NNS

   CAR-2166-B-401, Sheet 892, Fuel Pools and Refueling Water Purification Pump 1 & 4B-NNS

   CAR-2166-B-401, Sheet 895, Fuel Pools Skimmer Pump 1 & 4X-NNS

   CAR-2166-B-401, Sheet 897, Fuel Pools Cleanup System Annunciation

   CAR-2166-B-401, Sheet 904, Fuel Pool Cooling Pump 1 & 4A-SA

   CAR-2166-B-401, Sheet 905, Fuel Pool Cooling Pump 1 & 4B-SB

8.1 Drawings (continued)

3. Foreign Prints

VENDOR: Ingersoll-Rand Company EQUIPMENT: FPRW Purification Pumps

P.O. No: NY435009

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
2005	3040PG5/SFPRWPP	FUEL POOLS 7 REFUELING WTR PURIF PUMP MOTOR OUTL
20545	SPAD-15B/AMEND5	FUEL POOL & REFUELING WTR PURIF PUMP O/L
22733	3318B34	SPENT FUEL POOL WTR PURIF PMP MOTOR O/L 2 SH
35461	214-70	MOTOR DATA FOR SPENT FUEL POOL PURIF PMP MTR
48683	10VOC-B	SPENT FUEL POOL PURIF PUMP PERFORMANCE CURVE

VENDOR: Hungerford & Terry, Inc. EQUIPMENT: Spent Fuel Pool Demineralizer

P.O. NO.: NY435028

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
1917	SK27609-C2	SPENT FUEL POOL DEMINERALIZER NAMEPLATE DETAILS
1918	27609-B3	SPENT FUEL POOL DEMINERALIZER UNDERDRAIN HUB DETA
1919	27609-B4	SPENT FUEL POOL DEMINERALIZER INTERIOR REFERENCE
1920	27609-B2	SPENT FUEL POOL DEMINERALIZER UNDERDRAIN LATERALS
1921	27609-B1	SPENT FUEL POOL DEMINERALIZER INLET DISTRIBUTOR D
1922	27609-A1	SPENT FUEL POOL DEMINERALIZER TANK DETAILS
2153	SHSS-E-32	SPENT FUEL POOL DEMINERALIZER STRAINER ASSEMBLY

VENDOR: Yuba Heat Transfer Company EQUIPMENT: Fuel Pools Heat Exchanger

P.O. NO.: NY435029

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
1907	73-N-003-1-1	FUEL POOLS HEAT EXCHANGER OUTL
2751	73-N-003-1	FUEL POOLS HT EXCH BILL OF MATERIAL SH 1 TO 6
2752	73-N-003-1-5	FUEL POOLS HT EXCH DIST. BELT DETAILS
2753	73-N-003-1-2	FUEL POOLS HT EXCH SHELL 7 CHANNEL DETAILS

8.1 Drawings (continued)

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
3020	A2587	3/4 X 1 IN 150LB REL VA FOR SPENT FUEL POOL HEAT EXCH

VENDOR: Vacco Industries

P.O. NO.: NY435106

EQUIPMENT: Flushable Filters, Fuel Pool Skimmer Filters, Fuel Pool and Refueling Water Purification Filter, Fuel Pool Demineralizer Filter

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
7769	76283/SH1	FILTER HOUSE ASSY FUEL POOL SKIMMER FHB-236
7670	76283/SH2	FILTER HOUSE ASSY FP SKIMMER FILTER FHB-236
7671	76282/SH1	FILTER HOUSE ASSY FP 7 REFUEL PURIF FILTER FHB-236
7672	76282/SH2	FILTER HOUSE ASSY FP & REFUEL PURIF FILTER FHB-236
7673	76281/SH1	FILTER HOUSE ASSY FUEL POOL DEMINERALIZER FHB-236
7674	76281/SH2	FILTER HOUSE ASSY FP DEMIN FILTER FHB-236
3790	N1E10109/SH1	FUEL POOL SKIMMER FILTER FHB-236
3791	N1E10108/SH1	FUEL POOL REFUEL WATER PURIF FILTER FHB-EL 236
3792	N1E10112/SH1	SPENT RESIN SLUICE FILTER WPB-236
3793	N1E10107/SH1	FUEL POOL DEMINERALIZER FILTER FHB-236

VENDOR: Zurn Industries

EQUIPMENT: Strainers

P.O. NO.: NY435163

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
5435	I-771102-B	FUEL POOLS STRAINER FHB EL 236
5980	I-780619-A	FUEL POOLS SKIMMER PUMP SUCT STRAINER FHB EL 236

8.1 Drawings (continued)

VENDOR: Gould Pumps, Inc. EQUIPMENT: Fuel Pool Skimmer Pumps

P.O. NO: NY435181

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
8276	C784889N01	FUEL POOL SKIMMER PUMP O/L FHB EL 236
7321	1592/C784888912	FUEL POOL SKIMMER PUMP PERF CURVE
8273	C784889N02	FUEL POOL SKIM PUMP CROSS SECT & BILL OF MATL
23810	A-26152/7806JH	FUEL POOL SKIMMER PMP 1&4X-NNS PC&TL - FINAL
23811	A-26153/7805JH	FUEL POOL SKIMMER PMP 2&3X-NNS PC&TL - FINAL
15516	IDENT-L0301	FUEL POOL SKIM PUMP SPD TO PRTOUT
14406	5631D92	FUEL POOL SKIMMER PUMP MOTOR O/L 4SHS

VENDOR: Goulds Pumps Inc. EQUIPMENT: Spent Fuel Pool Cooling Pumps

P.O. NO.: NY435042

EBASCO DWG. NO.	DRAWING NO.	FUNCTIONAL TITLE
2296	N232723#1	FUEL POOLS COOLING PUMP O/L UNITS 2 & 3 FHB EL 236
2679	N23723#1A	FUEL POOLS COOLING PUMP O/L UNITS 1 & 4 FHB EL 236
2295	N232723#2	FUEL POOLS COOLING PUMP - CROSS SECTION
16182	C-25551	SPENT FUEL POOL COOLING PUMP PERF CURVE
5238	A-11596	SFP COOLING PUMP MOTOR SPEED TORQUE

4. General Arrangements

   CAR-2165-G-022 through 026, General Arrangements Fuel Handling Building - Plans and Sections

5. Piping Plans

   CAR-2165-G-438S01, Miscellaneous Piping Containment Building, Unit 1

   CAR-2165-G-252, FHB Piping Plan - EL 216, Units 1 and 4

   CAR-2165-G-253, FHB Piping Plan - EL 216 and 261, Units 1 and 4

8.1 Drawings (continued)

CAR-2165-G-254, FHB Piping Plan - EL 236, Sheet 1, Units 1 and 4

CAR-2165-G-255, FHB Piping Plan - EL 236, Sheet 2, Units 1 and 4

CAR-2165-G-256, FHB Piping Plan - EL 286, Sheet 1, Units 1 and 4

CAR-2165-G-257, FHB Piping Section, Sheet 1, Units 1 and 4

CAR-2165-G-258, FHB Piping Sections, Sheet 2, Units 1 and 4

CAR-2165-G-259, FHB Pipings Sections, Sheet 3, Units 1 and 4

CAR-2165-G-260, FHB Pipings Sections, Sheet 4, Units 1 and 4

CAR-2165-G-261, FHB Pipings Sections, Sheet 5, Units 1 and 4

CAR-2165-G-262, FHB Pipings Sections, Sheet 6, Units 1 and 4

CAR-2165-G-263, FHB Pipings Sections, Sheet 7, Units 1 and 4

CAR-2165-G-266, FHB Piping Plan - EL 286, Sheet 2, Units 1 and 4

6. Instrument Schematics and Logic Diagrams

CAR-2166-B-430, Fuel Handling (Fuel Pools) Sheet Nos. 4.1-4.8, 4.8A, and 4.9

7. Power Distribution and Motor Data Sheets CAR 2166-S-041, Sheets 177S01, 183S01, 227S01, 227S02, 254S01, 613, and 633

8.2 Specifications

Specification No. M-13, Spent Fuel Pool Cooling Pumps, Gould Pumps, Inc.

Specification No. N-15, Spent Fuel Pool Demineralizer, Hungerford & Terry, Inc.

Specification No. M-49Z, Series 514S Inlet Strainers, Zurn Industries

Specification No. M-24, Spent Fuel Pool Heat Exchangers, Yuba Heat Transfer Corporation

Specification No. M-10, Spent Fuel Pool Refueling Water Purification Pumps, Ingersoll Rand Company

Specification No. N-36, Flushable Filters, Vacco Industries

8.3 Technical Manuals

Spent Fuel Pool Cooling Pumps, Manual No. BHQ, Goulds Pumps, Inc.

Spent Fuel Pool Heat Exchangers, Manual No. MXJ, Yuba Heat Transfer Corporation

Series 514 Sinlex Strainer, Manual No. BRP, Zurn Industries

Spent Fuel Pool Demineralizer, Manual No. MXK, Vol. 2, Hungerford & Terry, Inc.

8.3 Technical Manuals (continued)

Spent Fuel Pool and Refueling Water Purification Pumps, BJH, Ingersoll Rand Company

Flushable Filters, Manual No. AYF, Vacco Industries

Fuel Pool Skimmer Pump, Manual No. IQY, Goulds Pumps, Inc.

8.4 Other References

Shearon Harris Nuclear Power Plant FSAR, Volume 16, Section 9.1.3, Fuel Pool Cooling and Clean-up System

Technical Specifications for Shearon Harris Nuclear Power Plant, Unit 1, Section 5.6, Paragraph 2

Shearon Harris Nuclear Power Plant Instrument List CAR-2166-B-432

SUMMARY OF CHANGES TO SD-116, REV. 7

Page	Description
All	Changed revision number to 7.
1	Added level of use note to header
13	Revised Note 1 per ESR 00-00046

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SIMPLIFIED FLOW DIAGRAM FUEL POOLS CLEAN-UP SYSTEMS SHEET 2 UNIT 1

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CPL-2165-S-0807, REV. 4:

SIMPLIFIED FLOW DIAGRAM FUEL POOLS COOLING SYSTEM UNIT 2

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CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description (SD)

NUMBER: SD-143.03

TITLE: Demineralized Water System

REVISION 2

Verify for outstanding changes before use

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1.0 SYSTEM PURPOSE

The purpose of the Demineralized Water System is to produce water at the following quality limits:

Silica (as SiO_2)	0.2 ppm
pH at 25°C	6-8
Oxygen	0.1 ppm
Chloride	0.15 ppm
Fluoride	0.15 ppm
Suspended Solids	1.0 ppm
Aluminum	0.05 ppm
Calcium	0.05 ppm
Magnesium	0.05 ppm

2.0 SYSTEM FUNCTION

The demineralized water treatment equipment is designed to deliver 680 gpm. The equipment is arranged in two (2) trains (340 gpm per train) that use a common steam water heater, caustic dilution water heater tank, and vacuum degasifier. Either train or both trains can be operated depending upon the system demand and regeneration requirements. Three (3) raw water feed pumps (one spare) take suction from the filtered water storage tank and discharge to the carbon filters (one per train). The carbon filters remove residual chlorine and any dissolved or suspended organic matter not removed by the Post Filtration System. From the carbon filters, the process water passes through a shell and tube steam heat exchanger. The process water temperature is raised to 85°F to improve the gas removal process in the vacuum degasifier. The heated water flows through a hydrogen ion exchange resin (cation) bed. The cation beds (one per train) convert salts in the process stream to their corresponding acids; sulfuric, hydrochloric, nitric, carbonic, and silicic. The carbonic acid is unstable and immediately breaks down into carbon dioxide (CO_2) and water. From the cation demineralizer beds the water flows to the upper section (5' O.D x 19' high) of the vacuum degasifier. The process water percolates or cascades through the polypropylene tower packing to the degasifier storage section (10' O.D. x 14' high). The tower packing enhances gas removal from the process water by exposing a large water surface area. Degasifier vacuum pumps remove both condensable and noncondensable gases from the process stream. After passing through a silencer and piping header, the gases are discharged outside the Water Treatment Building. By lowering the pressure in the degasifier, the gases are less soluble and thus are purged from the water. The degasifier transfer pumps take suction from the degasifier storage section and discharge to the hydroxide ion exchange resin (anion) beds. The anion demineralizer beds (one per train) remove the mineral acids: sulfuric, nitric and hydrochloric. The removal of these nonmetallic ions eliminate the slightly acidic condition that results from the cation and degasifier process. The process stream from the cation-degasifier-anion unit contains less than 3 ppm total ionizable solids (as $CaCo_3$), 0.05 ppm silica (as SiO_2) and 0.1 ppm oxygen. As the final step in the water treatment process, the water is passed through a mixed bed (cation-anion) demineralizer

2.0 SYSTEM FUNCTION (Cont'd)

for final polishing. The treated water contains less than 0.2 ppm ionizable solids (as $CaCO_3$), 0.01 ppm silica (as SiO_2) and 0.1 ppm oxygen. From the mixed bed demineralizers the treated water flows to the demineralized water storage tank (DWST). When a resin bed has depleted its ion exchange capabilities, the bed is exhausted and the effluent quality decreases and contaminates the Demineralized Water System with inorganic salts. In order to detect the inorganic salt break through, a sodium monitor is installed downstream of the mixed bed demineralizer. In order to prevent resin bed exhaustion, the resin beds are periodically regenerated. The acid storage tank and the acid pumps are used to thoroughly rinse and thereby regenerate the cation beds. The caustic storage tank and the caustic pumps perform the regeneration of the anion beds. Prior to regeneration of a mixed bed, the anion/cation mixture will be physically separated inside the mixed bed unit. This is done by back flushing the bed with partially treated (carbon filter, cation bed and anion bed) water at a high velocity (70 to 120 gpm). Since the anion material weighs less than the cation material, the anion material will rise to the top of the bed leaving the cation material in the lower portion of the bed. This can be verified by looking through the mixed bed unit sight glass. Upon completion of the separation, the regeneration cycle will begin. The caustic solution will be injected into the top of the bed and will then flow down through the anion material and then out through the interface collector line. The acid solution will be injected into the bottom of the bed and will flow up through the cation material and then out through the interface collector line. Upon completion of mixed bed regeneration, the anion/cation resin will be thoroughly mixed using the air blower and then rinsed.

A 500,000 gallon capacity tank is provided for demineralized water storage. Two (2) 100 percent capacity demineralized water transfer pumps supply demineralized water from the tank to the plant demineralized water distribution system piping. One of the two pumps will be in operation at all times to ensure a continuous demineralized water supply. The transfer pumps have minimum flow recirculation lines to protect the pumps during periods of low or no flow demand. The DWST can be bypassed and the treated water fed to the suction of the DWST transfer pumps if a chemistry excursion occurs in the DWST.

A stainless steel piping distribution system provides demineralized water to various site locations. The distribution system maintains the water level in the condensate storage tanks, refueling water storage tanks, and reactor makeup water storage tanks. Other systems supplied by demineralized water are:

(1) Waste Processing Sampling System (SD-120.11)
(2) Cask Decontamination (SD-115)

2.0 SYSTEM FUNCTION (Cont'd)

(3) Chemical and Volume Control System (SD-107)
(4) Filter Backwash System (SD-120.02)
(5) Waste Holdup and Evaporation System (SD-120.6)
(6) Auxiliary Steam System (SD-130)

3.0 COMPONENTS

3.1 Demineralized RAW Water Feed Pumps

Three (3) Goulds pumps (3 x 4-8G) Model 3196M7 are mounted on a single skid. One pump is an installed spare. Each pump is rated for 340 GPM at 160 feet of head. The pumps have 4-inch suction and 3-inch discharges with 7 5/9" diameter impellers. The impeller and casing are cast iron. Each pump is driven by a 3550 RPM, 30 hp 480 VAC electric motor powered from the Make-Up Demineralizer Control Panel.

3.2 Carbon Filters

The carbon filter tanks (A & B Train) are skid mounted. Each tank is 9 feet in diameter and approximately 10 feet high. The tanks are constructed on carbon steel and lined with a 6-mil coating of number 3066 Plasite. Each tank contains 250 cubic feet of 14 x 14 mesh activated carbon. Johnson well screen strainers (type 304 stainless steel) are installed below the bed to prevent loss of filter media. All connections to the tank are flanged connections. The tank is provided with a 24" manhole. Activated carbon has a high oxygen demand. Personnel should never enter the tank without an air supply.

3.3 Cation Bed Demineralizers

The cation bed demineralizers (A & B Train) are skid mounted. Each tank is 8.5 feet in diameter and approximately 11 feet high. Each cation bed demineralizer is rated for 340 gpm when it contains the proper amount of resin. The tanks have a 3/16" thick natural rubber lining. All connections to the tanks are flanged connections. Piping and valves associated with the tanks are polypropylene lines. The tanks are provided with acid connections for cation resin regeneration.

3.4 Vacuum Degasifier

The vacuum degasifier unit is 33 feet high. The degasifier portion of the unit is 19 feet high and 5 feet in diameter. The lower portion or integral storage section is 14 feet high and 12 feet in diameter. The upper portion of the degasifier contains 285 cubic feet of polypropylene tower packing. The process stream is sprayed into the upper section of the vessel. The water cascades/percolates through the packing exposing a large water surface area. Exposing a large water surface area allows the noncondensable gases to be removed. The lower section of the degasifier provides a storage well from which the degasified water transfer pumps take suction. The vacuum degasifier is a common unit for both the "A" and "B" trains.

3.5 Degasifier Vacuum Pumps

Two (2) Nash Model AT-704 vacuum pumps remove gases (primarily CO_2 and O_2) from the degasifier. The pumps are two (2) stage cast iron pumps driven through flexible couplings. The vacuum pumps are driven by 40 hp Siemens-Allis electric motors powered from the Makeup Demineralizer Control Panel.

3.6 Degasified Water Transfer Pumps

Three (3) Goulds pumps (3 x 4-8G) model 3196MT are mounted on a single skid adjacent to the vacuum degasifier. Each pump is rated for 340 gpm at 230 feet (TDH). One pump is an installed spare. The pumps are type 316 stainless steel. A 50 hp 480 VAC type CJ4B, frame 326TS, 3560 RPM PACEMAKER motor drives each pump powered from the Makeup Demineralizer Control Panel.

3.7 Anion Bed Demineralizers

The anion bed demineralizers (A & B Train) are skid mounted. Each tank is 8 feet in diameter and approximately 6 feet high. Each anion bed demineralizer is rated for 340 gpm when it contains the proper amount of resin. The tanks have a 3/16" thick natural rubber lining. All connections to the tanks are flanged connections. Piping and valves associated with the tanks are polypropylene lined. The tanks are provided with caustic connections for anion resin regeneration.

3.8 Mixed Bed Demineralizers

The mixed bed demineralizers are skid mounted. Each tank is 5 1/2 feet in diameter and approximately 8 feet high. Acid and caustic connections are provided for resin regeneration. The mixed bed provides the final water polishing prior to the demineralized water storage tanks.

3.9 Demineralized Water Storage Tank

The demineralized water storage tank (500,000 gallons) is located south of the water treatment building. The tank is constructed of stainless steel. The tank has manways, vents and flanged connections for piping. A coated nylon membrane diaphragm is attached to the internal tank shell. The primary function of the diaphragm is to prevent air from contacting the demineralized water surface. The diaphragm maintains the low oxygen content in the demineralized water. A nitrogen sparging system is available to maintain low oxygen in the tank.

3.10 Demineralized Water Storage Tank Transfer Pumps

Two (2) Goulds pumps, model 3196, are skid mounted between the demineralized water storage tank and the filtered water storage tank. Each pump is rated for 300 gpm at 455 feet (TDH). The pumps are driven by General Electric 75 hp electric motors powered from MCC-1-4B61. Pump A is fed from Compt. 4C and Pump B is fed from Compt. 4D.

3.11 Mixed Bed Resin Mix Air Blowers

Two Roots "Whispain Max" model #3505J air blowers are provided for mixing regenerated resins in the mixed bed units. The blowers are rated at 192 CFM @ 10 psig. The blowers are driven by a 480 VAC 15 hp electric motor powered from the Makeup Demineralizer Control Panel.

4.0 OPERATION

CAUTION:

Setpoints given in this SD are for reference only. Actual values should be obtained from a controlled setpoint document.

4.1 Normal Operation

The system is normally operated in the semi-automatic mode. In the semiautomatic mode the full time Water Treatment Building operator selects the train to be started up, operated, shut down and regenerated by positioning the appropriate selector switch. The selected train automatically performs the selected task and then waits until the next task is initiated by the operator.

4.2 Carbon Filter and Resin Bed Regeneration

4.2.1 Carbon Filter

The carbon filters are backwashed to remove the foreign material filtered out of the raw water during the service run. Only one carbon filter is backwashed at a time, as the other filter will be electrically locked into service. Resin beds downstream of the carbon filter should not be regenerated while the carbon filter is being backwashed.

4.2.2 Resin Bed Regeneration

The resin bed regeneration (cation and anion beds) can be regenerated individually in the manual mode or as a train in the semiautomatic mode.

4.2.2 Resin Bed Regeneration (Cont'd)

A train regeneration is when one cation and one anion is regenerated. Once a train regeneration is started, one cation and one anion will regenerate and rinse to quality.

Electrical interlocks have been provided to prevent a train regeneration from starting if a carbon filter is in a washing cycle, the other train is in regeneration, the waste neutralization basin is at high level, or either mixed bed is in a regeneration cycle. The above interlock conditions must be satisfied before a train regeneration will be started.

When a train regeneration is started, the anion will backwash first, using water from the cation. The cation will start its regeneration. The anion will continue its regeneration and wait for the cation to complete its regeneration before the anion will final fast rinse. After its final fast rinse, the train will return to service, provided the quality of water is satisfactory.

All valve selector switches on the train to be regenerated must be in the automatic position. All selector switches for the acid and caustic regeneration systems must also be in the automatic position. Indicator lights on the control panel for each valve will indicate whether a valve is opened or closed. A red indicator light for open valves and a green indicator light for closed valves. Indicator lights have also been provided to show whether the train is running, regenerating or exhausted.

In semiauto, a regeneration cycle for the train is started by pressing the semiautomatic start push button. In manual position, all valves may be operated by the selector switches on the control panel. This manual position is the only position in which the individual valves on the panel will open or close a valve. In off position, all valves will close and any pumps running for regeneration will stop. The manual selector switches may not be operated in this off position.

To start an automatic regeneration cycle, the master selector switch must be in the semiautomatic position and the semiautomatic push button pressed or the master selector switch must be in the full automatic. A regeneration will be started by the meter ratio controller or high effluent conductivity. The master selector switch must be in manual for manual regenerations.

The mixed beds may be started into a regeneration cycle at any time, by moving the selector switch to the semiautomatic position or pressing the semi-automatic push button. Interlocks have been provided which will prevent a mixed bed from starting a regeneration if the carbon filters are in a washing cycle, Train A or B is in a regeneration, the acid or caustic tanks are at low level or the other mixed bed is in a regeneration. If the selector switch is in full automatic, a regeneration will be started (provided none of the above interlocks hold off a regeneration) when the effluent/ anticipatory conductivity is high or the effluent counter counts 3,000,000 gallons.

4.2.2 Resin Bed Regeneration (Cont'd)

For a mixed bed to be regenerated, at least one train of cation and anions must be in service to provide water to the mixed bed being regenerated. All valve selector switches for the mixed bed being regenerated must be in the automatic position. One acid and one caustic pump selector switch must be in the automatic position.

4.3 Technical Specifications

No Technical Specifications apply to this system.

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

System	Function of Supporting System
Acid and Caustic (SD-144)	Demineralizer regeneration
Auxiliary Steam (SD-130)	Water heating prior to degasification
Instrument Air (SD-151)	Operation of pneumatic valves
Service Air (SD-151)	As needed for each unit
120 & 480 VAC Power (SD-156)	Buses for Demineralize Water System - GSB-1-4A6 & MCC-1-4B61
Nitrogen	DWST oxygen sparging
Waste Neutralization	Receive waste

5.2 System to System Crossties

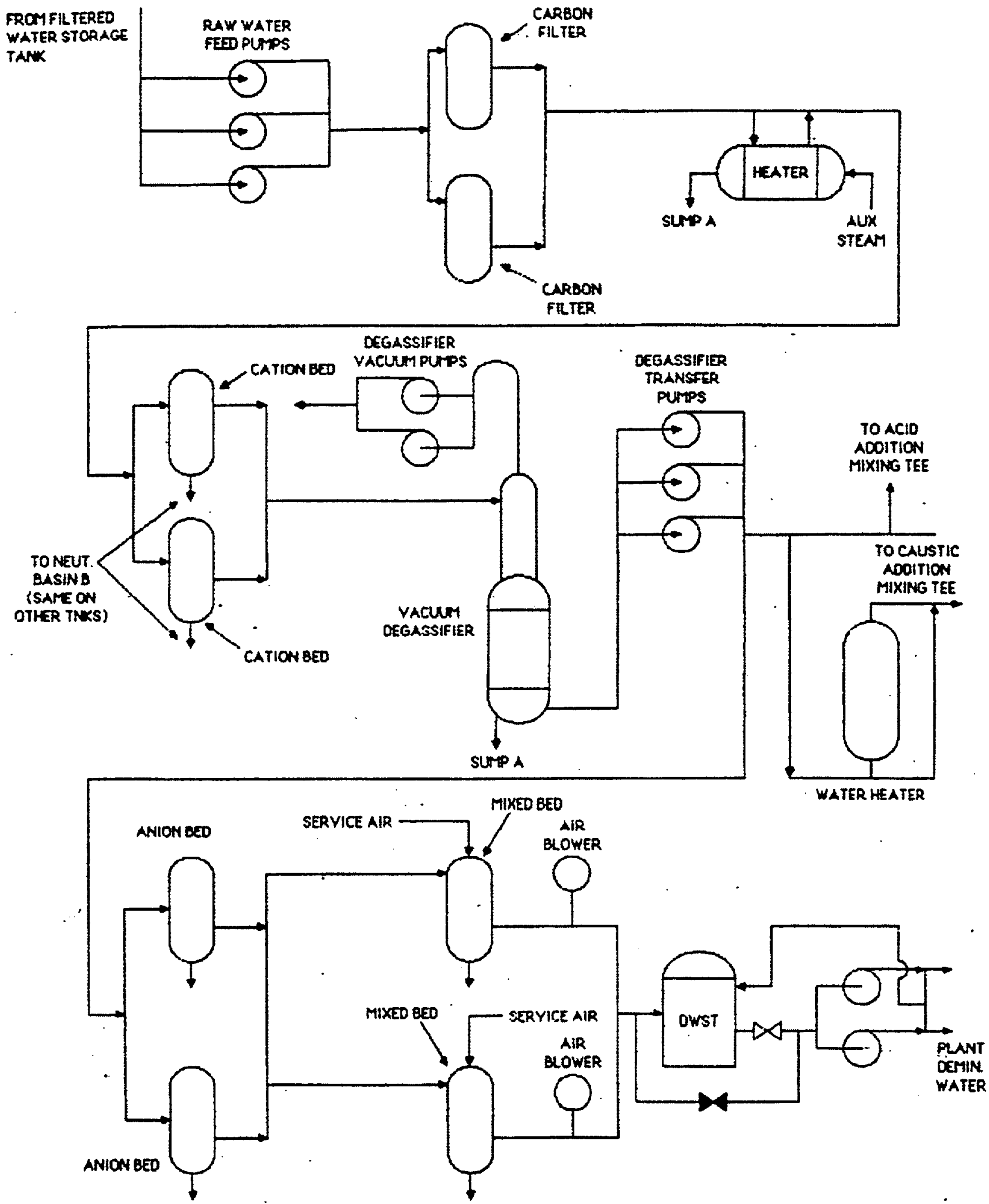
The Demineralized Water System supplies demineralized water throughout the plant. Refer to Figure CAR-2165-S-549S02 for complete listing of systems supplied by Demineralized Water System.

6.0 TABLES

None

7.0 FIGURES

7.1 Demin Water System



SD 143.03
DEMIN WATER SYSTEM
FIGURE 7.1

8.0 REFERENCES

8.1 Drawings

Drawing No.	Description
2165-G-035	Water Treatment Facility - Gen. Arrangement
2165-G-049S01	Potable and Demin. Wtr. Headers - Flow Diagram
2165-G049-S02	Demin. Wtr. Headers - Flow Diagram
2165-G-110S02	Water Treatment - Flow Diagram
2165-G-220	Water Treatment Bldg. Piping - Plans and Sections
2165-G-221	Water Treatment Bldg. Piping - Plans and Sections
2165-S-549S01	Potable and Demin. Wtr. Headers - Simplified Flow Diagram
2165-S-549S02	Demin. Wtr. Headers - Simplified Flow Diagram
2165-S-610S02	Water Treatment - Simplified Flow Diagram
1364-27082	Makeup Demi. - Train a Wiring Diagram
1364-27083	Mixed Bed 1A Wiring Diagram
1364-27086	Regeneration Timers - Wiring Diagram
1364-27087	Acid Regeneration - Wiring Diagram
1364-27088	Caustic Regeneration - Wiring Diagram
1364-27090	Power Dist. and Circuit Breaker Panel
1364-27091	Annunciator - Wiring Diagram
1364-27092	Sequence Contact Charts
2166-B-401	Make-up Demineralizer System - CWD
2355-2365	

8.2 Purchase Orders

P. O. #	Name
NY-226	Makeup Demineralizers
NY-229	Demineralized Wtr. Storage Tank

8.3 Technical Manual - MXK

Hungerfort & Terry's Makeup Demineralizers Manual.

8.4 Other

FSAR-9.2.3 Demineralized Water Makeup System

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SIMPLIFIED FLOW DIAGRAM POTABLE AND DEMINERALIZED WATER SYSTEMS UNIT 1

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CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description (SD)

NUMBER: SD-112

TITLE: Containment Spray System

REVISION 8

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1.0 SYSTEM PURPOSE

The primary purpose of the Containment Spray System (CSS) is to remove heat and fission products from a post-accident containment atmosphere by:

1. Functioning as a Containment Heat Removal System (CHRS), thereby reducing the containment temperature and pressure following a loss-of-coolant accident (LOCA) or a main steam line break (MSLB), and

2. Functioning as an Iodine Removal system (IRS), thereby reducing the amount of airborne radioactive iodines inside containment following a LOCA.

2.0 SYSTEM FUNCTION

CAUTION

Setpoints given in this SD are for reference only. Actual values should be obtained from a controlled setpoint document.

A simplified flow diagram of the CSS is depicted in Figure 7.1.

2.1 Containment Heat Removal

By reducing the temperature and thus the pressure inside containment, the CSS acts to prevent containment rupture and to limit the leakage of contaminants to the outside environment. In order to perform this function, the CSS sprays a solution of borated water and sodium hydroxide into the containment building (the purpose of the sodium hydroxide is discussed in Section 2.2). As the spray droplets fall through containment, they absorb heat from the surrounding atmosphere and thereby cool and depressurize the containment.

Another Containment Heat Removal System is the Containment Cooling System (CCS). The CCS works in conjunction with the Containment Spray System in limiting containment temperature and pressure. See SD-169 for a description of the Containment Cooling System.

2.2 Iodine Removal

In the event of containment leakage or rupture, airborne iodine removal reduces the amount of contaminants that are available to be released offsite. (In the case of a secondary break, iodine removal will not be necessary.)

To enhance the iodine removal, sodium hydroxide is mixed with the borated water to obtain a solution pH of between 8.5 and 11. (Iodine is absorbed by water that has a pH value greater than seven.) This pH provides optimum iodine absorption without excessive corrosion to equipment inside containment. The NaOH is stored in a 28% to 30% solution inside the containment spray additive tank (CSAT) and is mixed with the borated water through an eductor.

2.2 Iodine Removal (continued)

As the spray droplets fall through the containment atmosphere, they absorb heat, and they remove the inorganic (molecular) iodine (I_2) and some particulate iodine. In addition, the increased pH of the SI recirculation flow through the reactor core will inhibit further release of iodine to the containment atmosphere. Since most of the iodine in the containment atmosphere will be in the molecular form, the effectiveness of the CSS will be determined by its ability to remove I_2. The CSS is not effective in removing organic iodine (CH_3I), the small amount of CH_3I produced (less than .005 percent per hour of the total iodine within containment) is removed by the Airborne Radioactive Removal (ARR) System, see SD-168. For more detailed information on iodine removal, reference the SHNPP FSAR Section 6.5.2.

2.3 Design Bases

There are a number of design bases associated with the CSS (Reference FSAR Sections 6.2.2.1 and 6.5.2.1). The CSS is capable of removing heat from containment to keep the containment temperature and pressure below design conditions for any size break up to and including a double ended break of the largest reactor coolant pipe, or a double ended break of the largest main steam line inside containment.

It should be noted that the heat removal capacity of either the Containment Spray System or the Containment Cooling System is sufficient to maintain the containment temperature and pressure below design conditions for any size break.

Another design basis of the CSS deals with the chemical compatibility of the spray solution with materials inside containment. One concern here is with the possible clogging of the spray nozzles by colloidal suspension or precipitates resulting from chemical interactions. Aluminum is the most susceptible material to caustic chemical reactions; hence its use inside containment has been highly limited. Another area of concern is the production of hydrogen from chemical interaction. Zinc, in particular, is susceptible to the hydrogen production reaction and as such has been limited in its use.

As mentioned, clogging is a major concern in the proper operation of the CSS. Along with colloidal suspensions or precipitates, debris from inside containment is also a concern. The primary source of such debris is piping and equipment insulation. As a result, strict criteria for piping and equipment insulation have been imposed.

In the event that debris reaches the sump level, various other safeguards have been designed into the system. These safeguards deal mainly with the recirculation sumps. See Section 3.5.

3.0 COMPONENTS

3.1 Containment Spray Pumps

The two containment spray pumps are vertical, single stage, centrifugal units which are located on the 190' Elevation of the RAB. The pumps are driven by electric motors which are rated at 350 HP each. They are designed to pump 2275 gpm of basic, borated water from either the RWST or the containment recirculation sumps. The design head at this flow rate is 425 feet. See Figures 7.2 and 7.3 for the pump performance curves.

The Containment Spray Pumps 1A-SA and 1B-SB are powered from the 480V Emergency Busses 1A2-SA Compt 4C, and 1B2-SB Compt 1D, respectively. Both pumps have control switches located on the MCB Panel 1AA desk section. See Figure 7.5.

3.2 Cavitating Venturis

The cavitating venturis are located in the downstream piping of each containment spray pump on the 190' elevation of the RAB. During the early stages of the CSS injection mode, the venturis prevent CSS pump run out by restricting flow immediately downstream of each pump's discharge. The venturis are designed so as to present a minimal pressure drop once steady state operation is achieved.

The venturis are 8 inches in diameter and are constructed of 316 stainless steel built to ASME III, Class 2 Specifications.

3.3 Containment Spray Eductors

Eductors are devices which use the kinetic energy of a pressurized liquid to entrain another liquid, mix the two, and discharge the mixture at a lower pressure. The two eductors of the CSS are each rated to draw the 28 to 30 wt % NaOH solution from the CSAT at a rate of 25 gpm. In the case of the CSS, the pressurized liquid is a portion of the spray pump discharge (60 gpm), and the eductor discharge point is the spray pump suction. The stainless steel eductors are located on the 190' Elevation of the RAB.

NOTE: Two orificed lines in parallel to eductors provide the correct flow rate through each eductor, while maintaining proper pump minimum recirculation flow of 250 gpm.

3.4 Containment Spray Headers and Nozzles

There are four 360 ° circular spray headers mounted in the containment dome. These are divided into two trains of two headers each identified as Train A and Train B. Each train is supplied by one of two pumps. The layout of the CSS headers and nozzle orientation provides a minimum spray coverage of 92.6% of the containment free volume and 95% of the surface area of the operating floor. (Elevation 286') with only one spray train in operation. There are 106 nozzles per train for a total of 212 nozzles with a design flow of 15.2 gpm each. The ramp-bottom design nozzles are constructed of stainless steel in accordance with the ASME III Code, Class 2 specifications. The inlet connector is a one inch screwed end with an outlet of 3/8 inch. Mean drop diameter is 700 microns with a back pressure of 40 psi. Design pressure of the nozzles is 150 psi with design temperature of 258 °F.

The specified containment grating has an 80% free area to ensure spray coverage beneath the operating level. Note that this grating also prevents debris from reaching the recirculation sumps.

3.5 Containment Recirculation Sumps

There are two independent sumps inside containment (Elevation 221') which serve as collection reservoirs and provide suction to the RHR (SD-111) and CSS pumps during their recirculation modes of operation. The RHR and CSS pump intakes are separated by a concrete wall to avoid flow turbulence to either pump. Note that this separating wall has a rectangular opening near the bottom which connects sumps together (see SD-113).

As mentioned in Section 2.3, the sumps are designed to guard against debris induced clogging. Some of the design safeguards are discussed below:

1. Each recirculation sump is covered with a removable checker plate steel cover. In addition, the sump wall openings are provided with two-stage stainless steel screens which are comprised of:

    a. A stainless steel coarse outer screen with openings having an area of approximately 2.25 inches ^{2}.

    b. A stainless steel fine inner screen with openings no larger than 0.125 inch in diameter. Note that any particles entering the system will be less than 0.125 inches and therefore should pass through the spray nozzles which have a 0.375 inch diameter.

2. A curb approximately 18 inches high and located 2 feet in front of the screen structure is provided to prevent heavy debris from impinging upon the screens. The floor outside of the curb slopes away from the sump to inhibit debris from accumulating at the sump.

3.5 Containment Recirculation Sumps (continued)

3. The velocity of the water in the immediate sump screen area is limited to 0.1 feet/second. This velocity, which is achieved by pump and piping design, is limited to permit high density particles to settle out on the floor, thus minimizing the possibility of their clogging the screens.

The recirculation sumps are provided with one Level Transmitter each (LT-7160A/B). The 219'4" and 224'4" Elevations correspond to 0% and 100% indicated level, respectively. A low level alarm occurs at 43% indicated level (i.e., 221.5') if a recirculation sump isolation valve is open.

The recirculation sumps have been analyzed for satisfactory hydraulic performance via testing of scale models by Alden Research Laboratory (see References). The potential for screen blockage due to signs installed inside containment was analyzed per PCR-4142, and this evaluation established limits/restrictions on sign installation.

3.5.1 Containment Wide Range Sump Level Monitoring

The containment wide range level instruments are provided for post-accident monitoring and consist of Level Transmitters LIT-7162A/B. The 211'9-3/4" and 230'3-3/4" Elevations correspond to 0% and 100% indicated levels, respectively. A high level alarm occurs at 88% indicated level (i.e., 228'1").

3.6 Refueling Water Storage Tank (RWST)

The Refueling Water Storage Tank (RWST) is a 469,000 gallon stainless steel tank (Reference FSAR 6.2.2) constructed to Seismic Category I, Nuclear Safety Class 2 Standards. The water for the RWST contains 2400 to 2600 ppm boron and is supplied from the CVCS through Safety Injection System Piping. Electric strip heaters keep the borated water within the insulated tank heated to a minimum of 40 °F.

The RWST provides water for 20 minutes of operation during the injection phase with two charging and safety injection pumps, two RHR pumps, and two containment spray pumps in operation. During refueling, the tank provides enough water to fill the refueling cavity, fuel transfer tube, and fuel transfer canal. Level indications located on the tank (see Figure 7.1) allow operators to monitor tank level at all times. The four level alarms are: high (98.4%), low (94.4%), low-low (23.4%), and empty (3.0%).

The RWST is equipped with vents which release to the atmosphere and with an overflow and drain line connected to the Boron Recycle System. The tank is not equipped with an internal bladder.

3.6 Refueling Water Storage Tank (RWST) (continued)

Note that a significant amount of electrical conduit is located inside the concrete barrier surrounding the RWST and within a few inches of the floor. Some problems have been experienced due to water levels inside the barrier entering this conduit. For this reason, it is essential that the area inside RWST barrier be drained before it reaches conduit.

A tank curve showing "gallons" versus "indicated level" is maintained in the Main Control Room curve book. The outlet nozzle centerline is located at 264'6". The 266'5" and 301'1" elevations correspond to 0% and 100% indicated levels, respectively.

3.7 Containment Spray Additive Tank (CSAT)

The Containment Spray Additive Tank (CSAT) is a 7098 gallon tank (Reference Drawing 1364-2124) constructed of 304 stainless steel and is located on the 216' Elevation of the RAB. The liquid contained in the CSAT is a 28 to 30 weight percent NaOH solution with a nitrogen blanket. A 2 psig nitrogen blanket is maintained to assure solution stability and to prevent degradation during long-term storage.

A 30 weight percent NaOH solution has a freezing point of approximately 32°F, and a boiling point of 240 °F at atmospheric pressure. The environmental conditions of the CSAT in the RAB, thus, preclude the need for special tank temperature control.

The tank is protected against overpressurization by a relief valve. The tank is also protected by two vacuum breakers. The CSAT has an outside diameter of 8 feet with a length of 20 feet; shell thickness is 0.25 inches with a net weight of 10,759 pounds.

The CSAT has two level transmitters (See Figure 7.1). The 218.0' and 222.2' Elevations correspond to 0% and 100% indicated levels, respectively. Low and empty level alarms are provided at 92.5% and 2.0% indicated level, respectively. A curve of "% indicated level" versus "gallons" is maintained in the Main Control Room curve book.

3.8 Containment Spray Valves

Power supplies for the motor operated valves are listed in Table 6.1.

3.8.1 1CT-11, 1CT-12 Containment Spray Chemical Additive Valves

These two normally closed valves are located on the supply lines which lead from the CSAT to each containment spray eductor. They are two-inch globe-type valves constructed of stainless steel. These valves are designed to ASME III, Code Class 3 specifications with a design pressure of 50 psig and a design temperature of 200 °F. the valves automatically open on a CSAS. They may also be positioned from their control switch located on the MCB Panel 1AA, vertical section. These valves also close (train specific) on CSAT empty alarm.

3.8.2 1CT-24, 1CT-25 Containment Spray Eductor Test Valves

These two inch globe valves are located on the eductor test line. These valves will close automatically on a "T" signal, if they are open for eductor testing. The valves may be positioned manually (only during test) by their control switches on the MCB Panel 1AA, desk section. See Figure 7.5.

3.8.3 1CT-26, 1CT-71 Containment Spray Injection Supply Valves

These 12-inch gate valves are located on the supply lines for the A and B Trains leading from the RWST to the containment spray pumps. These valves are twelve inches in size and are normally open. These valves can be positioned from the MCB Panel 1AA, desk section. See Figure 7.5.

3.8.4 1CT-102, 1CT-105 Containment Spray Sump Recirculation Isolation Valves

These valves are located on the lines which lead from the containment sumps to the spray pump suction headers. Each 12-inch gate valve is contained inside a separate valve chamber on the 190' Elevation of the Containment Building. control switches for these valves are located on the MCB Panel 1AA, desk section. See Figure 7.5.

3.8.5 1CT-47, 1CT-95 Containment Spray Pumps Recirculation Valves

These six-inch gate valves are located on the recirculation lines of each of the containment spray pumps. They are normally closed with their circuit breakers locked open to ensure the valves will not actuate during containment spray operation. Control switches are located on the MCB Panel 1AA, desk section. See Figure 7.5.

3.8.6 1CT-50, 1CT-88 Containment Spray Header Isolation Valves

These eight-inch gate valves are located on the lines which lead to the containment spray headers. The valves will open automatically on a CSAS or may be operated by control switches mounted on the MCB Panel 1AA, desk section. See Figure 7.5. These valves require 10CFR50, Appendix J, Leak Rate Testing (i.e., LLRT).

3.8.7 1CT-40, 1CT-70 Pump Recirculation Line Relief Valves

These relief valves have been abandoned in-place, and slip/pancake flanges are installed on the discharge side of each valve (Reference PCR-667).

3.8.8 1CT-53, 1CT-90 Injection Line Isolation Check Valves

These valves are containment isolation valves and they require 10CFR50, Appendix J, Leak Rate Testing (i.e., LLRT).

4.0 OPERATIONS

CAUTION

Setpoints given in this SD are for reference only. Actual values should be obtained from a controlled setpoint document.

The CSS has two principle modes of operation. These are:

1. The initial injection mode, during which time the CSS sprays borated water which is taken from the RWST (sodium hydroxide is introduced through the eductors).

2. The recirculation mode which is initiated when a low-low level (23.4%) is reached in the RWST. Pump suction is automatically transferred from the RWST to the recirculation sump.

4.1 System Actuation

The CSS receives two signals from the Engineered Safety Features Actuation System (SD-103) which are essential for system actuation (SD-112). These are the Phase "A" Containment Isolation Signal ("T" Signal) and the Containment Spray Actuation Signal (CSAS).

Before CSS operation may begin, a certain system lineup must be present. The "T" signal assures the presence of this lineup by automatically actuating (if necessary) the following components:

NOTE: An abnormal CSS lineup should only occur during system testing.

1. Containment Spray Pumps - If being tested during the receipt of the "T" signal, these pumps will stop.

2. Containment Spray Recirculation Valves (1CT-47 and 1CT-95) - If the CSS is being tested, these valves will be open to provide a flow path back to the RWST. Upon receipt of a "T" signal they will close.

3. Containment Spray Eductor Test Valves (1CT-24 and 1CT-25) - A "T" signal will close these valves if they are open for eductor testing.

The CSAS is the actuating signal of the containment spray system. This signal can be initiated by either of two means:

4. Manually - There are four momentary control switches for the manual initiation of the CSAS. Initiation of the CSAS will occur when two associated control switches (left two or right two) are operated simultaneously. See Figure 7.6 for the MCB location of these switches. See SD-103.

4.1 System Actuation (continued)

5. Automatically - Automatic initiation will occur on a containment pressure signal of 10 psig (Hi-3 signal) on two out of four instrument channels. See SD-103.

Two containment spray reset switches are provided on the MCB (see Figure 7.5). If the operator determines that the CSAS initiation was inadvertent, he may reset both CSS trains (one reset for each train), thus terminating spray flow. This will minimize the amount of caustic water entering containment.

4.2 Injection Mode

Upon receipt of the CSAS, the injection mode of operation begins. The CSAS will automatically start the containment spray pumps and open the following valves:

1. Containment Spray Headers Isolation Valves (1CT-50 and 1CT-88) and,

2. Containment Spray Chemical Additive Valves (1CT-11 and 1CT-12).

Concurrent with the pump starts, the 28 to 30 wt % sodium hydroxide solution will be drawn through the eductors and mixed with the 2400 - 2600 ppm boric acid solution (from the RWST). The mixture enters the mainstream flow upstream of the containment spray pumps and 32 seconds following system actuation will reach the spray nozzles. The CSS will operate in this manner until its switchover to the recirculation mode.

During a main steam or feedwater line break, sodium hydroxide addition will not be necessary or desirable. Valves 1CT-11 and 1CT-12 may be closed from the MCB in these cases.

4.3 Recirculation Mode

The switchover from injection to recirculation is an automatic action which transfers the containment spray pumps suction from the RWST to the recirculation sumps. This automatic action, which is triggered by a low-low level (23.4%) in the RWST (coincident with a CSS pump running), involves the opening of the Containment Sump Recirculation Valves (1CT-102 and 1CT-105) and the closing of the Injection Line Isolation Valves (1CT-26 and 1CT-71). A time delay is present between the opening of the recirculation line valves and the closing of the injection line valves to allow sufficient time for the recirculation line to fill. This assures there will be an available NPSH for the containment spray pumps at all times.

4.3 Recirculation Mode (continued)

As sodium hydroxide is used, the CSAT will reach a level which corresponds to a spent volume of approximately 3300 gallons. When this occurs, Transmitters, LT-7150 and LT-7166, will each send a signal to close their corresponding Chemical Addition Isolation Valve (1CT-12 and 1CT-11 respectively). The automatic closure occurs at empty alarm level (2.0%). If the CSAT should become spent and it is discovered that more sodium hydroxide is needed, the emergency sodium hydroxide addition connection may be utilized.

4.4 Technical Specifications

The following list paraphrases the Limiting Conditions for Operation (LCO) that directly deals with the CSS. For the exact wording and the action statement, see a controlled copy of the Technical Specification:

1. 3.1.2.5 - For Modes 5 and 6, this SHNPP Technical Specification requires that as a minimum, one of the following borated water sources shall be OPERABLE:

   a. A Boric Acid Tank with:

      (1) A minimum contained borated water volume of 6650 gallons which is equivalent to 21% indicated level,

      (2) A boron concentration between 7000 and 7750 ppm, and

      (3) A minimum solution temperature of 65 °F.

   b. The RWST with:

      (1) A minimum contained borated water volume of 106,000 gallons which is equivalent to 12% indicated level,

      (2) A boron concentration of 2400 to 2600 ppm, and

      (3) A minimum solution temperature of 40 °F.

2. 3.1.2.6 - For Modes 1,2,3, and 4, this SHNPP Technical Specification requires that as a minimum, the following borated water sources shall be OPERABLE:

   a. A Boric Acid Tank with:

      (1) A minimum contained borated water volume of 24,150 gallons, which is equivalent to 74% indicated level,

      (2) A boron concentration of 7000 to 7750 ppm, and

      (3) A minimum solution temperature of 65 °F.

4.4 Technical Specifications (continued)

b. The RWST with:

(1) A minimum contained borated water volume of 436,000 gallons, which is equivalent to 92% indicated level,

(2) A boron concentration of 2400 to 2600 ppm, and

(3) A minimum solution temperature of 40 °F, and

(4) A maximum solution temperature of 125 °F.

3. 3.3.3.6 - For Modes 1, 2, and 3, this Technical Specification requires certain postaccident monitoring instruments to be OPERABLE. These instruments include RWST Level, Containment Wide Range and Recirculation Sump Levels, and Containment Spray Additive Tank Level.

4. 3.5.4 - For Modes 1, 2, 3, and 4, this SHNPP Technical Specification requires that the refueling water storage tank (RWST) shall be operable with:

a. A minimum contained borated water volume of 436,000 gallons, which is equivalent to 92% indicated level,

b. A boron concentration of 2400 to 2600 ppm boron,

c. A minimum solution temperature of 40 °F, and

d. A maximum solution temperature of 125 °F.

5. 3.6.2.1 - For Modes 1, 2, 3, and 4 this SHNPP Technical Specification requires that two independent Containment Spray System shall be OPERABLE with each Spray System capable of taking suction from the RWST and transferring suction to the containment sump.

6. 3.6.2.2 - For Modes 1, 2, 3, and 4 this SHNPP Technical Specifications requires that the Spray Additive System shall be operable with:

a. A spray additive tank containing a volume of between 3268 and 3964 gallons, indicated level between 92% and 96%, of 28% to 30% by weight NaOH solution, and

b. Two spray additive eductors each capable of adding NaOH solution from the chemical additive tank to a Containment Spray System pump flow.

7. 3.6.3 - For Modes 1, 2, 3, and 4, this Technical Specification requires the containment isolation valves to be operable with acceptable isolation times.

NOTE: The following Containment Spray System Valves are Containment Isolation Valves: 1CT-50, 1CT-88, 1CT-53, 1CT-91, 1CT-102, 1CT-105.

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

5.1.1 Chemical and Volume Control System (SD-107)

The CVCS boric acid blending components provide makeup to the RWST at its specified boron concentration.

5.1.2 Nitrogen Supply System (SD-152.01)

The Nitrogen Supply System maintains a 2 psig nitrogen blanket inside the CSAT to assure solution stability and to prevent degradation during long-term storage.

5.2 System-to-System Cross Ties

The following cross ties deal specifically with the RWST.

5.2.1 Safety Injection System (SD-110)

The RWST provides suction to the SIS hydrotest pump, which provides makeup to the three cold leg accumulators. The RWST also accepts borated water from the isolation valves test headers, and the hydrotest pump relief valve.

5.2.2 Residual Heat Removal System (SD-111)

The RWST provides suction to the two RHR pumps during the injection phase of safety injection, and during refueling operations (filling the cavity). The tank also receives back the refueling water following these operations.

5.2.3 Chemical and Volume Control System (SD-107)

The RWST provides suction to the CVCS charging pumps when the VCT level becomes low, or during safety injection (injection phase).

5.2.4 Spent Fuel Pool Cooling and Cleanup System (SD-116)

The RWST can be used to fill the new fuel pool and transfer canal during refueling. The RWST may also accept back this water when refueling is completed.

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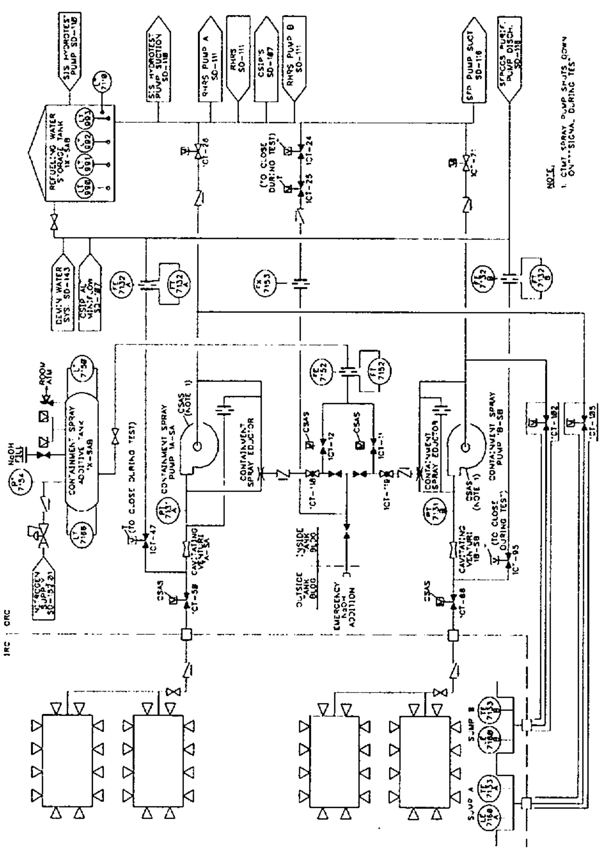
6.0 TABLES

6.1 Power Supplies for Motor Operated Valves

Valve	480V MCC - Compt. #
1CT-11	1B21-SB-8A
1CT-12	1A21-SA-9C
1CT-24	1A21-SA-4A
1CT-25	1B21-SB-10E
1CT-26	1A21-SA-10B
1CT-47	1A21-SA-12B
1CT-50	1A21-SA-10C
1CT-72	1B21-SB-7B
1CT-88	1B21-SB-7C
1CT-95	1B21-SB-9A
1CT-102	2B21-SB-6A
1CT-105	1A21-SA-8C

7.0 FIGURES



SD-112
CONTAINMENT SPRAY SYSTEM
FIGURE 7.1

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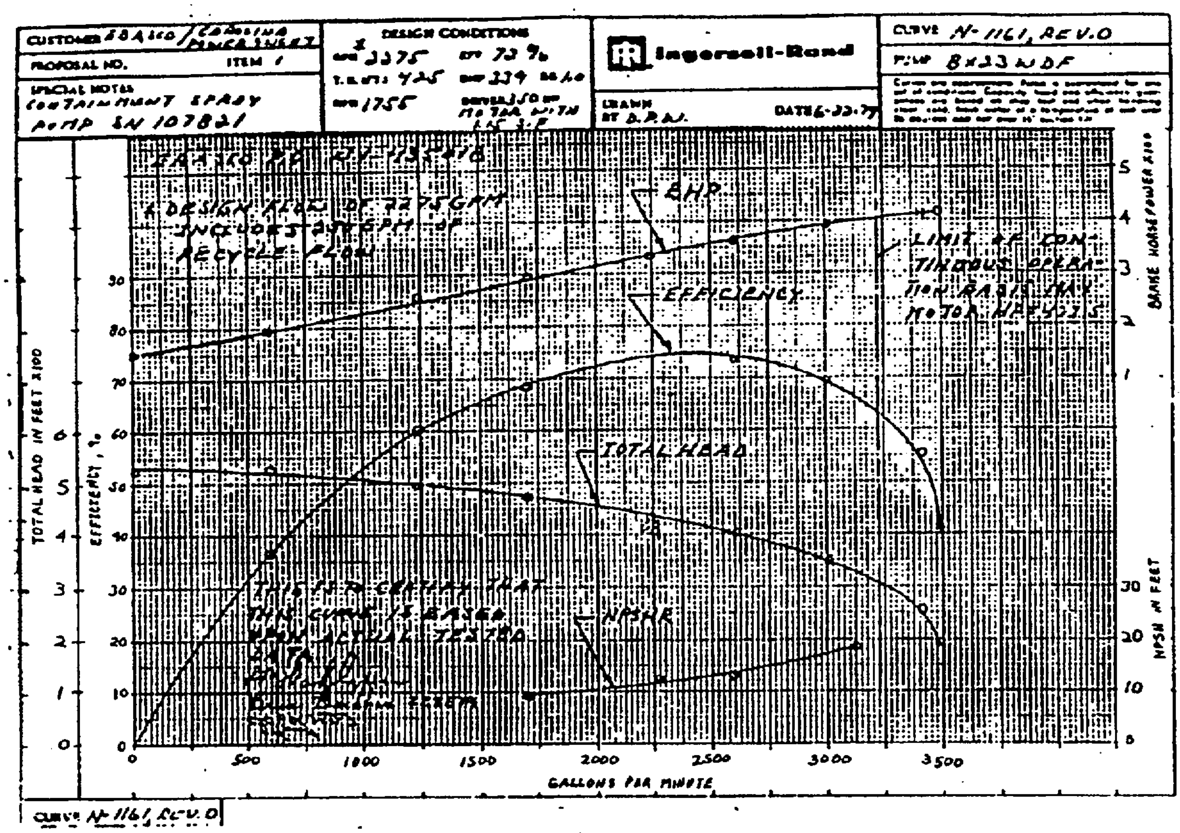
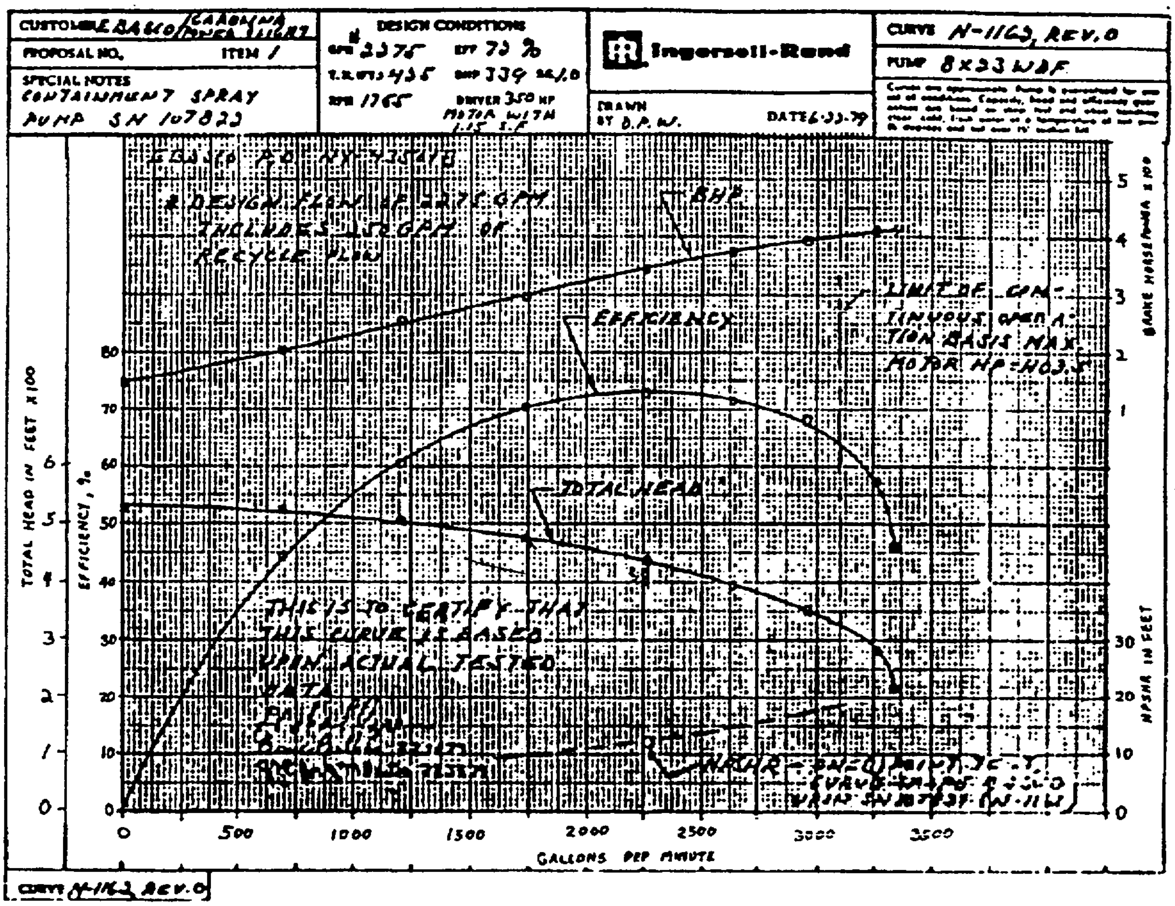


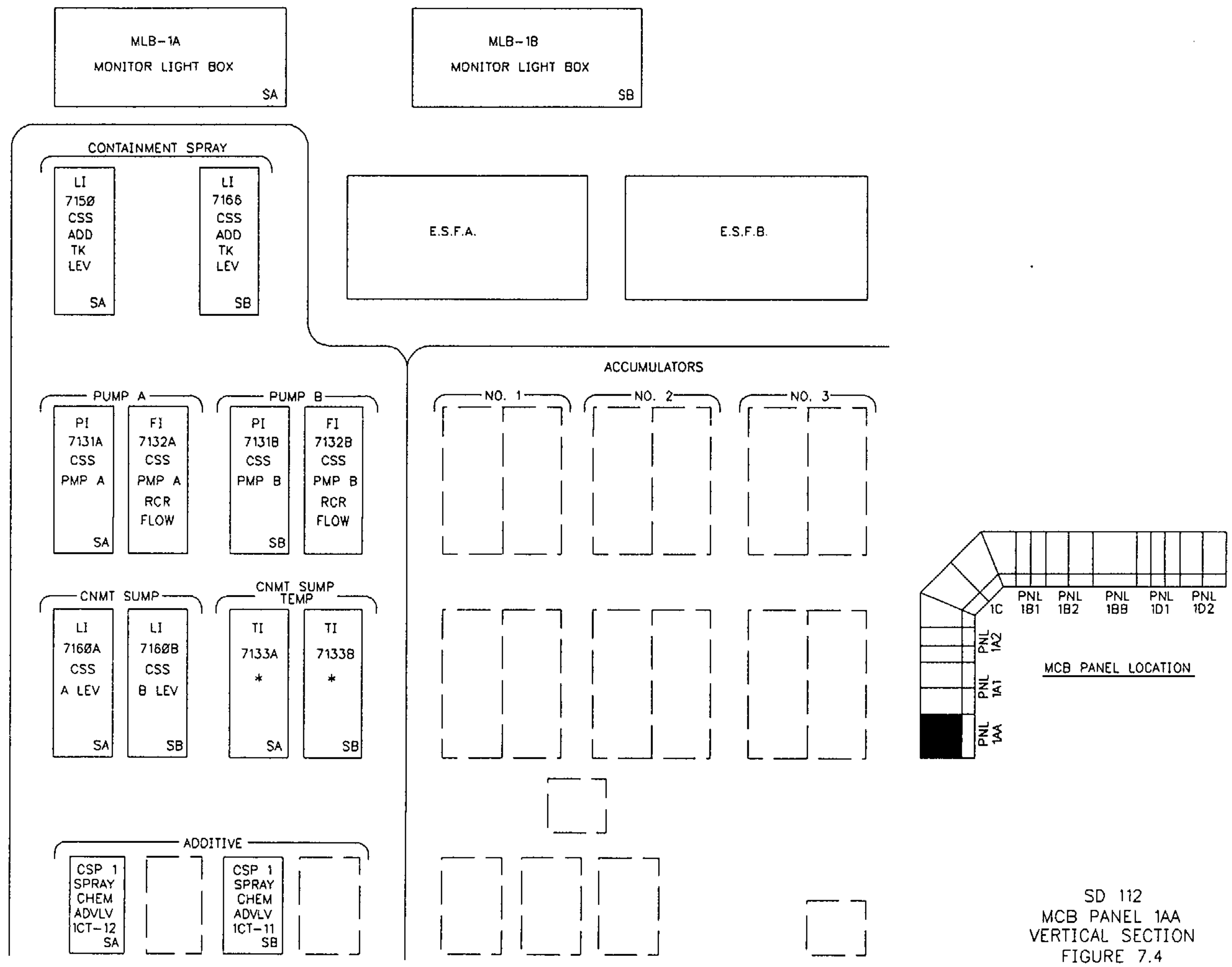
Reference Ebasco EMDRAC Drawing Number 1364-045715 Sheet 1-4

SD 112
CSS PUMP 1A-SA
PERFORMANCE CURVE
Figure 7.2

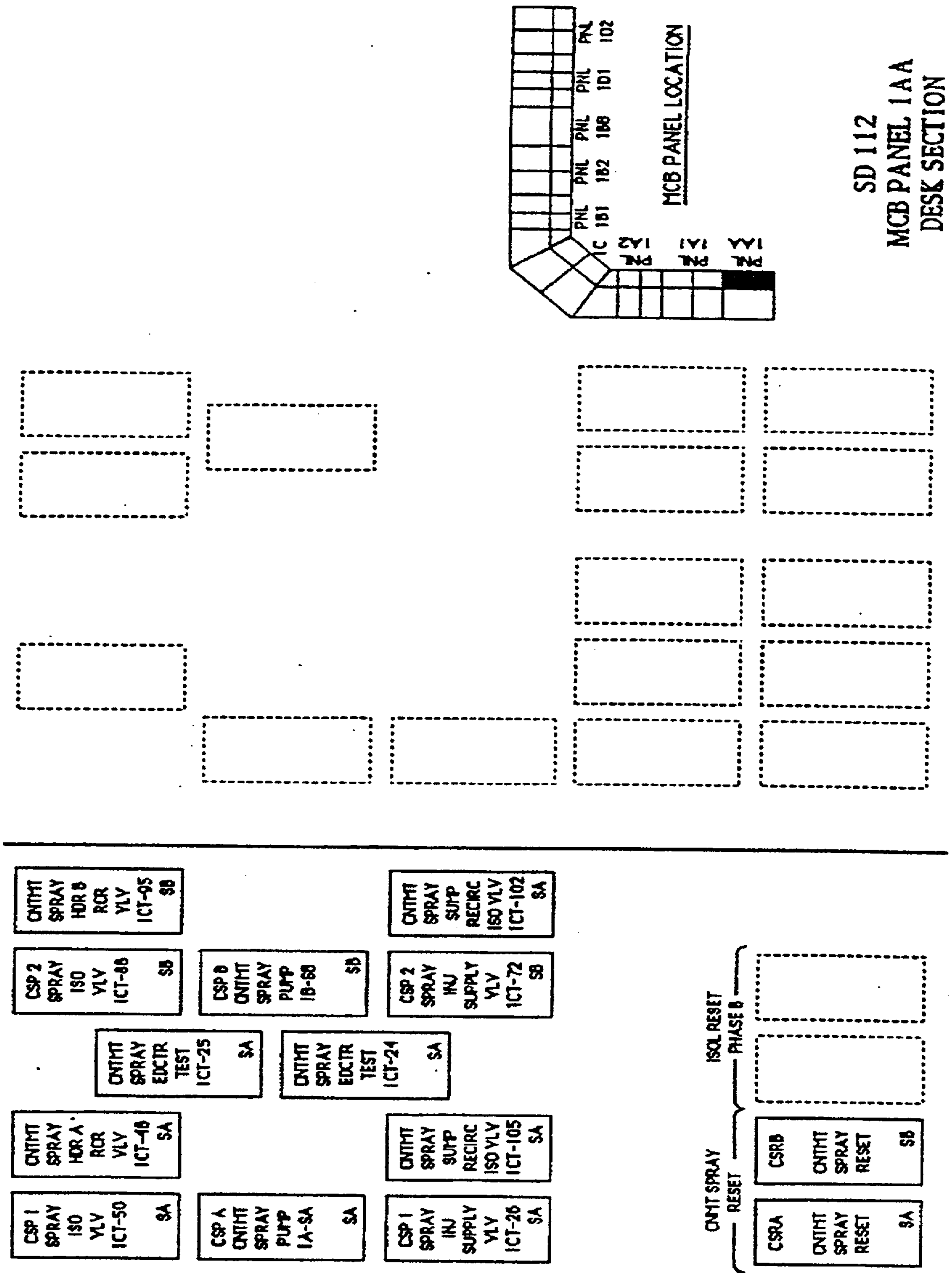


Reference Ebasco EMDRAC Drawing Number 1364-045715 Sheet 5-8

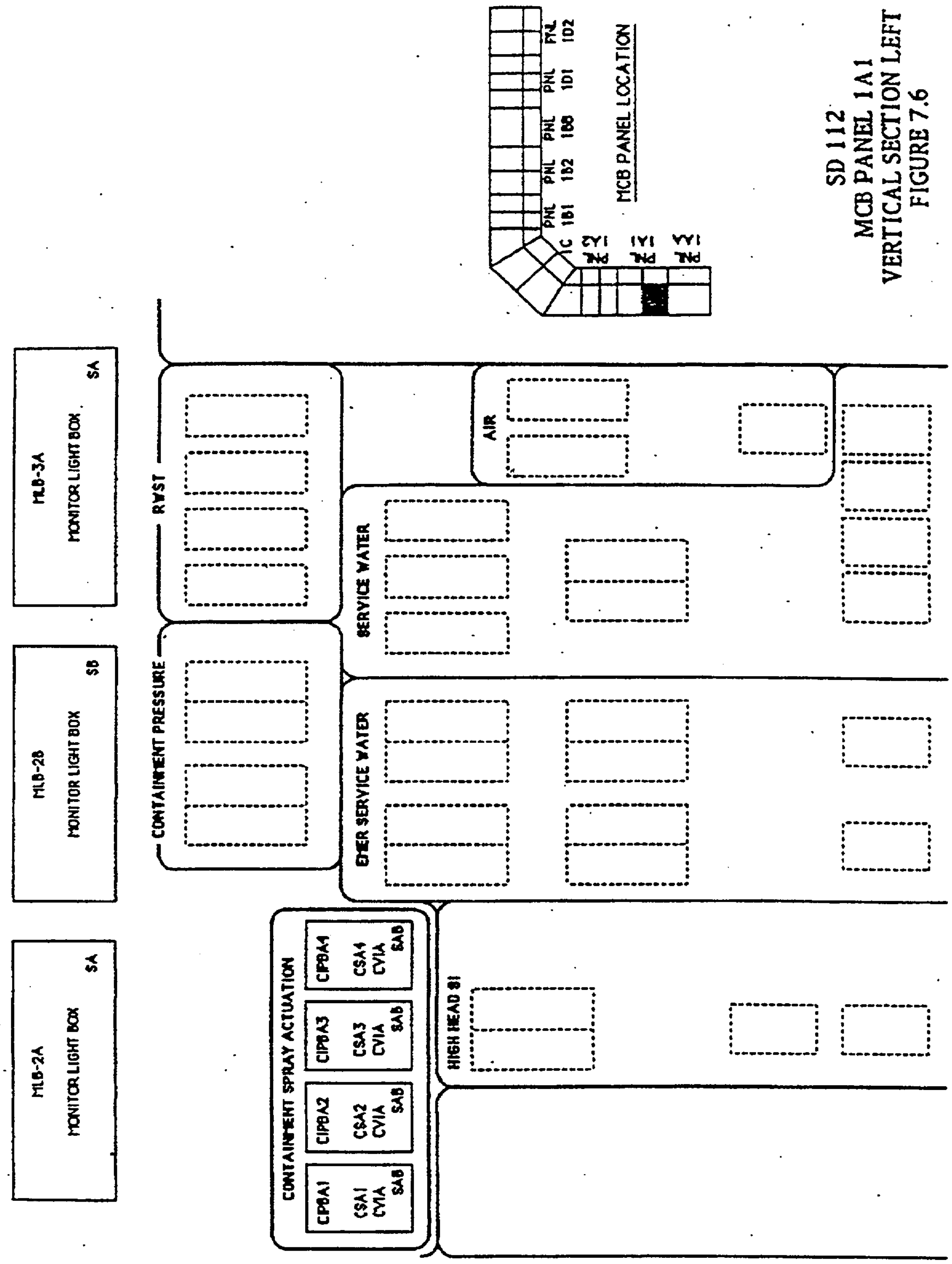
SD 112
CSS PUMP 1B-SB
PERFORMANCE CURVE
Figure 7.3



SD 112
MCB PANEL 1AA
VERTICAL SECTION
FIGURE 7.4



SD 112
MCB PANEL 1AA
DESK SECTION
FIGURE 7.5



SD 112
MCB PANEL 1A1
VERTICAL SECTION LEFT
FIGURE 7.6

8.0 REFERENCES

8.1 Drawings

8.1.1 Flow Diagrams

CAR-2165-G-050 Flow Diagram Containment Spray System

CPL-2165-S-0550 Simplified Flow Diagram Containment Spray System

8.1.2 Instrument Schematics and Logics

CAR-2166-G-423 Containment Spray System

CAR-2166-B-430 Sheet 26.1 Containment Water Levels, Leak detection, and Wide Range Pressure

8.1.3 Control Wiring Diagrams

CAR-2166-B-401 Sheet 1021 Containment Spray Pump 1A-SA

CAR-2166-B-401 Sheet 1022 Containment Spray Pump 1B-SB

CAR-2166-B-401 Sheet 1023 Containment Isolation Phase A and Containment Vent Isolation Actuation and Reset - Train A

CAR-2166-B-401 Sheet 1024 Containment Spray Actuation, Train A

CAR-2166-B-401 Sheet 1025 Containment Spray Actuation, Train B

CAR-2166-B-401 Sheet 1026 Containment Isolation Phase A and Containment Ventilation Isolation Actuation and Reset - Train B

CAR-2166-B-401 Sheet 1027 Containment Spray Pump 1A-SA Injection Supply Valve, 2CT-V2SA-1 (1CT-26)

CAR-2166-B-401 Sheet 1028 Containment Spray Pump 1B-SB Injection Supply Valve, 2CT-V3SB-1 (1CT-71)

CAR-2166-B-401 Sheet 1029 Containment Isolation Phase B Actuation and Reset - Trains A and B

CAR-2166-B-401 Sheet 1030 Containment Header A Isolation Valve 2CT-V21SA-1 (1CT-50)

CAR-2166-B-401 Sheet 1031 Containment Header B Isolation Valve 2CT-V43SB-1 (1CT-88)

CAR-2166-B-401 Sheet 1033 Containment Header A Recirculation Valve 2CT-V25SA-1 (1CT-47)

CAR-2166-B-401 Sheet 1034 Containment Header B Recirculation Valve 2CT-V49SB-1 (1CT-95)

8.1.3 Control Wiring Diagrams (continued)

CAR-2166-B-401 Sheet 1036 Containment Chemical Additive "A" Valve 3CT-V85SA-1 (1CT-12)

CAR-2166-B-401 Sheet 1037 Containment Chemical Additive "B" Valve 3 CT-V88SB-1 (1CT-11)

CAR-2166-B-401 Sheet 1039 Containment Sump "A" Recirculation Isolation Valve 2CT-V6SA-1 (1CT-105)

CAR-2166-B-401 Sheet 1040 Containment Sump "B" Recirculation Isolation Valve 2CT-V7SB-1 (1CT-102)

CAR-2166-B-401 Sheet 1041 Containment Spray System - Instrumentation and Alarms, Sheet 1

CAR-2166-B-401 Sheet 1042 Containment Spray System - Instrumentation and Alarms, Sheet 2

CAR-2166-B-401 Sheet 1043 Containment Spray System - Instrumentation and Alarms, Sheet 3

CAR-2166-B-401 Sheet 1044 Containment Spray Pump Motors 1A-SA and 1B-SB Computer Inputs

CAR-2166-B-401 Sheet 1045 Refueling Water Storage Tank Level Instrumentation

CAR-2166-B-401 Sheet 1046 Containment Sump Redundant Level Instrumentation

CAR-2166-B-401 Sheet 1047 Containment Sump Unidentified Leakage

CAR-2166-B-401 Sheet 1061 Containment Spray Eductor Test Valve 2CT-V8-SA-1 (1CT-24)

CAR-2166-B-401 Sheet 1062 Containment Spray Eductor Test Valve 2CT-V145-SB-1 (1CT-25)

CAR-2166-B-401 Sheet 2387 Drawing shows RWST Level (LT-7110) and RWST Temp (TE-7110)

8.1.4 General Plans and Installation Details

CAR-2165-G-116 Containment Spray Piping Reactor Auxiliary Building Plan Elevation 190'

CAR-2165-G-117 Containment Spray Piping Reactor Auxiliary Building Plan Elevation 236'

CAR-2165-G-118 Containment Spray Piping Reactor Auxiliary Building Partial Plans and Sections

8.1.4 General Plans and Installation Details (continued)

CAR-2166 B-431 Sheet L-63 Containment Narrow Ranger Level Transmitters (LE-7161) Installation Details

CAR-2166 B-431 Sheet X-38 Gems Level Transmitter Generic Installation Details

CAR-2166 B-431 Sheet L-64 Containment Wide Range Level Transmitters (LE-7162) Installation Details

CAR-2165-G-119 Containment Spray Piping Plan and Sections

8.1.5 Vendor Drawings

Vendor - BIF Division of General Signal
Equipment - Cavitating Venturis

Ebasco 1364 Drawing Number	Title
15329	Cavitating Venturi (Containment Spray System RA Building E207

Vendor - Graham Manufacturing Company, Inc.
Equipment - Containment Spray Eductors

Ebasco 1364 Drawing Number	Title
5549	Containment Spray Eductor
43870	Containment Spray Eductors Performance Curves and Spec. 4SHS and Cover
44661	Containment Spray Eductor O/L Units 1, 2, 3, 4
44662	Containment Spray Eductor O/L for Unit 2
44663	Containment Spray Eductor O/L for Unit 3
44664	Containment Spray Eductor O/L for Unit 4
45632	Containment Spray Eductor Performance Curves 4 SHS

Vendor - Spraco Spray Engineering Co.
Equipment - Containment Spray Nozzle

Ebasco 1364 Drawing Number	Title
3034	Containment Spray Nozzle

8.1.5 Vendor Drawings (continued)

Vendor - Richmond Engineering Company, Inc.
Equipment - Containment Spray Additive Tank

Ebasco 1364 Drawing Number	Title
2122	Containment Spray Additive Tank Nameplate Details
2123	Containment Spray Additive Tank MH Davit and L Lug DE
2124	Containment Spray Additive Tank Details

Vendor - Ingersoll-Rand Company
Equipment - Containment Spray Pumps and Motors

Ebasco 1364 Drawing Number	Title
2458	Containment Spray Pump Mechanical Seal
3009	Current Versus Time Curves for Containment Spray Pump
3010	Motor Outline-Containment Spray Pumps
4965	Motor Data for Containment Spray Pump Motor
7037	Containment Spray Pump Seal Water Piping Arrgt 3SH
7038	Containment Spray Pump O/L and Notes 7SH RAB EL 190
7039	Containment Spray Pump-Cross Sectional Assy 3 SH
7040	Containment Spray Pump Speed-Torque Curve
9806	Containment Spray Pump-Orifice-Seal Water Piping
44685	Containment Spray Pump Motor Commercial Test Data
45715	Containment Spray Pumps Performance Curves and Test Results 10SHS

Vendor - Vickery Sims, Incorporated
Equipment: Recirculation Line Orifices

Ebasco 1364 Drawing Number	Title
1364-3687	FE-7132A/B Cont. Spray Pumps A and B Recirc Flow Calculation

8.1.5 Vendor Drawings (continued)

Vendor - Richmond Engineering Co., Inc.
Equipment: RWST

Ebasco 1364 Drawing Number	Title
47724	45'O.D. x 45' High Refueling Water Storage Tank (RWST)

Vendor - Westinghouse Electric Company
Equipment: RWST Level Instrumentation

Ebasco 1364 Drawing Number	Title
1364-11923,	Level Systems Installation Schematic, Sheets 2 and 12Refueling Water Storage Tank
1364-1328	Westinghouse RWST Level Process Control Block Diagram

Vendor - TransAmerica DeLavel
Equipment: Containment Sump Level Instruments

Ebasco 1364 Drawing Number	Title
1364-48366	Containment Narrow Range Level Transmitters LE-7161A1B Details
1364-48367	Containment Wide Range Level Transmitters LE-7162 A3 and B3 Details
1364-48370	Containment Wide Range Level Transmitters LE-7162 A2 and B2 Details
1364-48375	Containment Wide Range Level Transmitter Installation Specifications and Wiring
1364-48376	Containment Level Instruments "Modular Receiver"
1364-48377	Containment Level Instruments "Modular Receiver" Wiring Schematic

Vendor - Clow Pumps
Equipment:

Ebasco 1364 Drawing Number	Title
1364-2828	Containment Sump Pumps (includes Sump Details)

8.1.6 Power Distribution Diagrams

CAR-2166-B-041, Sheet 126, CT Pump 1A-SA Power Supply

CAR-2166-B-041, Sheet 131, CT Pump 1B-SB Power Supply

CAR-2166-B-041, Sheet 172S02, CT Spray Valves 3CT-V85SA-1, 2CT-V6SA-1 and 2CT-V8SA-1

CAR-2166-B-041, Sheet 172S03, CT Spray Valves 2CT-V2SA-1, 2CT-V21SA-1 and 2CT-V25SA-1

CAR-2166-B-041, Sheet 178S01, CT Spray Eductor Test Valve 2CT-V145SB-1

CAR-2166-B-041, Sheet 178S02, PDMD, CT Spray Valves 2CT-V49SB-1, 2CT-V3SB-1, 2CT-V43SB-1, 3CT-V88SB-1, and 2CT-V49SB-1

CAR-2166-B-041, Sheet 607, Power Distribution and Motor Data, 208/120V Power Panel PP-1E211

CAR-2166-B-041, Sheet 814, Power Distribution and Motor Data, FPP-HT-18751N (RWST Freeze Protection)

CAR-2166-B-041, Sheet 815, Power Distribution and Motor Data, FPP-HT-18751P (RWST Freeze Protection)

8.2 Technical Manuals

Manual Number	P. O. Number	Vendor	Equipment
BJH	NY435018	Ingersoll-Rand	Containment Spray Pumps
IJV	NY435018	Westinghouse	Containment Spray Pumps Motors
ONM		TransAmerica DeLaval	Containment Sump Level Transmitters

8.3 Other

SHNPP Final Safety Analysis Report, Sections 6.2, 6.5.2, 7.3, 6.3.2, 7.5.2, TMI Section

SHNPP Technical Specifications, Sections 3/4.5.4, 6.2.1, 6.2.2, 3/4.6.3

Design Basis Document #106, Containment Spray System

Scaling Calculation SC-N-155, 156, 157, 158 (RWST Level)

Scaling Calculation SC-B-145 and SC-B-349 (CSAT Level)

Scaling Calculation SC-B-144, 147 (Containment Recirc. Sump Level)

Scaling Calculation SC-B-353, 355 (Containment Wide Range Level)

8.3 <u>Other</u> (continued)

SHNPP Setpoint Document, CAR-2166-B-508

PCR-4142; Engineering Evaluation for "Sign Installation Inside Containment."

Reactor Containment Recirculation Sump Evaluation, Shearon Harris Units 1 and 2, by Alden Research Laboratory, September 1984

RWST Heat Tracing Drawings HT-18751A Sheets 16, 17, and 18

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: CPL-2165 S-0550, REV. 14: SIMPLIFIED FLOW DIAGRAM CONTAINMENT SPRAY SYSTEM UNIT 1

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: CPL-2165 S-0550, REV. 14

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

R
Reference
Use

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description (SD)

NUMBER: SD-139

TITLE: Service Water System

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1.0 SYSTEM PURPOSE

The Service Water System is made up of two separate systems, the Emergency Service Water System (ESWS) and the Normal Service Water System (NSWS). The ESWS circulates water from the ultimate heat sink (UHS) through plant components required for safe shutdown of the reactor following an accident, and returns the water to the UHS. The ESWS performs its cooling function following a loss-of-coolant accident (LOCA) or loss of off-site power, automatically and without operator action. Redundancy built into the system provides protection for a single active or single passive failure.

The ESWS also provides an emergency source of water for the Auxiliary Feedwater System (AFWS), Essential Services Chilled Water System (ESCWS), and the Fire Protection System (FPS).

The Normal Service Water System circulates water from the Cooling Tower (CT) and Cooling Tower Makeup System through plant auxiliary components and back to the Cooling Tower. The NSWS serves no safety function, but does provide cooling water to the ESW headers during normal operation. NSW temperature is influenced by lake water temperature due to continuous Cooling Tower Makeup. The winter average temperature is in the sixties and the summer is in the nineties.

2.0 SYSTEM FUNCTION

2.1 Emergency Service Water (ESW) System

The Emergency Service Water System consists of two intake structures (one on the auxiliary reservoir and one on the main reservoir); two emergency service water pumps, valves, and strainers; two emergency service water booster pumps; two 30-inch diameter safety-related supply headers (A&B) with all associated branches and heat exchangers; two safety-related return headers; and the discharge structure for the return of water to the auxiliary reservoir. These components are arranged into two completely independent redundant trains (A&B) each capable of supplying sufficient cooling water for plant safety. Figures 7.1 and 7.2 provide simplified flow diagrams of the Emergency Service Water System and Figure 7.4 shows the general location of ESW yard piping.

2.1.1 ESW Main Flow Path

The water source to the Emergency Service Water (ESW) System originates from the auxiliary reservoir (preferred source) or the main reservoir (backup source). The preferred supply flows from the auxiliary reservoir through the ESW intake canal to the ESW intake screening structure. As the water enters the structure, the flow is divided by the structure into separate bays. In each bay, the water flows through a trash rack and a traveling screen (Reference SD-140) to remove debris greater than 7/16 inch, and through a normally-open, manually-operated butterfly valve. The water exits the bay through a 30-inch diameter coated (inside is epoxy paint, outside is coal tar) steel pipe and gravity flows to the respective ESW pump bay in the ESW and Cooling Tower Make-Up (CTMU) Intake Structure. The ESW backup source of water flows from the main reservoir via the ESW and CTMU intake canal to the ESW and CTMU Intake Structure where the flow is divided by the structure into bays. Within each intake bay, the water flows through a trash rack and a finer traveling screen as in the ESW intake screening structure. The main reservoir

2.1.1 ESW Main Flow Path (continued)

water is stopped from flowing into the ESW pump suction bay by a normally-shut, manually-operated rectangular butterfly valve. The ESW pumps discharge through a check valve and a self-cleaning strainer that removes debris larger than 1/16 inch. During normal plant operation, the Normal Service Water System supplies cooling water to heat loads on the Emergency Service Water Header. The ESW pump discharge check valve prevents NSW System backflow through the pump to the auxiliary reservoir. From the strainer, the water exits the ESW and CTMU Intake Structure through underground 30-inch diameter coated steel pipes (one pipe per safety train). The two supply headers enter the tank building and drop down into the elevation 216′ pipe tunnel that runs the entire length of the reactor auxiliary building. Branch lines from supply header A provide cooling water to all safety train A components. Similarly, branch lines from supply header B provide cooling water to all safety train B components. When the ESW System is required [safety injection signal occurred, loss of off-site power, or cooling water inlet (auxiliary reservoir) temperature <35°], both headers are supplied with water. Containment cooling and auxiliary reservoir makeup requirements to avoid Tech Spec LCOs may result in running both ESW pumps/trains during the summer months.

The heated water returns by branch lines to the train A or B return header (30-inch diameter) located in the elevation 216′ pipe tunnel. The headers exit the plant area via motor-operated butterfly valves (1SW-270 and 1SW-271) and are routed underground to the ESW discharge structure. In addition to supplying cooling water, the ESW System provides a source of water to the Screen Wash System (SD-140) and is a backup source of water to the Essential Chilled Water System, Auxiliary Feedwater System, and to the Fire Protection System. Supply water to the Auxiliary Feedwater System can be controlled from the Main Control Room.

Four 4" drain valves (gate) are provided on the ESW system for rapid draining of the supply and return headers. These are 1SW-1495, 1SW-1496, 1SW-1497, and 1SW-1498.

The ESW System alternate suction path from the main reservoir is the result of NRC Regulatory Guide 1.27 requirements. Two 8' x 10', manually-operated butterfly valves are located in the seismic Category 1 wall separating the main reservoir intake from the Emergency Service Water pump chamber. In order to shift suction, the 30-inch, manually-operated butterfly valves (1SW-1 and 1SW-2) in the suction lines from the Auxiliary Reservoir and the 8' x 10' valves (1SW-3 and 1SW-4) from the Main Reservoir are repositioned. With both suction valves in an ESW train open (1SW-1, 1SW-3 for "A" Train; 1SW-2, 1SW-4 for "B" Train), water will flow from the Auxiliary Reservoir to the Main Reservoir due to the difference in the reservoir levels.

2.1.2 ESW Interconnections

The ESW System's supply headers cannot be cross-connected. For example, ESW Pump 1A-SA cannot supply water to the B train supply header and vice versa. Some components can be aligned to either header since, during normal operation, only one emergency service header may be in service and is supplied by the Normal Service Water System. Service water supply to the turbine-driven auxiliary feedwater pump is normally isolated, but may be aligned to either header in the event of an emergency. The charging pump oil coolers have their supply and return isolation valves aligned such that each pump is supplied by only one service water train, A or B, depending on the respective pump's electrical lineup. Valve alignment for the C charging pump depends on its electrical lineup.

2.1.3 ESW Branch Flow Paths

2.1.3.1 CVCS Chiller

The branch to the CVCS chiller contains air-operated valves that shut automatically on a Safety Injection (SI) signal. Thus, during an emergency this flow path would be isolated. During normal operation, the CVCS chiller is aligned to only one train at a time.

2.1.3.2 Auxiliary Feed Pump

The turbine-driven auxiliary feed pump branch contains normally-shut, motor-operated valves. In the event Emergency Service Water is needed for auxiliary feedwater, the control room operator would select which ESW header to use, open the appropriate supply valves, and have an auxiliary operator shut the associated loop seal line isolation valve. The valves from both headers would not be opened at the same time since a piping failure on one service water train could affect the flow in the other train.

2.1.3.3 Charging Pump Oil Coolers

The charging pump oil cooler branches contain only manual isolation valves. These lines are sized (1½ inch diameter) such that a failure of these lines would not materially affect the service water flows to other components.

2.1.3.4 Component Cooling Water Heat Exchangers, Diesel Generator Coolers, RAB HVAC Chiller

The branch flow path from the A supply header to the component cooling heat exchanger, diesel generator jacket water coolers, and auxiliary building HVAC chiller condensers is independent of the B service water header. There are manual butterfly isolation valves with this equipment.

2.1.3.5 Containment Fan Cooler Units

The branch flow path to the containment fan cooler units contains the service water booster pump, which starts on an emergency (SI) signal. During normal operation, service water flow bypasses the idle booster pump, enters containment through the motor-operated butterfly isolation valves, flows through the fan cooler coils and back to the ESW return header through the containment isolation valves and a flow control orifice. This flow control orifice has an air-operated, normally-open bypass valve in parallel such that if the booster pump is off, the flow restriction is minimal. However, when the booster pump starts, this valve shuts, forcing all the fan cooler return flow through the orifice. The purpose of the booster pump and orifice is to ensure that, during a design basis Loss of Coolant Accident, the service water pressure inside containment is higher than containment pressure. This ensures any leakage will be from service water into containment and will prevent the release of containment radioactivity via the ESW System.

2.1.3.6 Post Accident Sampling System (PASS)

Branch flow from the A and B supply headers is supplied to the PASS. Manual isolation valves are provided for the supply and return lines. Only one train of supply and return valves (A or B train) may be open at any time to prevent cross-connection of safety trains following an accident.

2.1.3.7 Plant Air Compressors

Emergency Service Water can be aligned to supply cooling water to all three plant air compressor aftercoolers. Either train can be aligned to supply the air compressor aftercoolers with cooling water. When in Modes 1 through 4, the ESW header supplying the air compressor aftercoolers is declared inoperable. At no time should both trains be aligned to the air compressor aftercoolers as this would cross connect the ESW headers.

2.2 Normal Service Water (NSW) System

The Normal Service Water System supplies cooling water from the cooling tower basin and Cooling Tower Makeup System to various plant components and systems. The Normal Service Water System consists of the intake structure, the distribution header, two 100 percent capacity pumps, self-cleaning strainers, motor-operated valves, and the supply and return headers to/from the Waste Processing Building, Turbine Building, Reactor Auxiliary Building, and the Containment Building. Figure 7.3 provides a flow diagram of the NSW system and identifies the components supplied by NSW.

2.2.1 NSW Main Flow Path

Water from the cooling tower basin is supplied to the NSW intake chamber by a 6-foot diameter underground concrete conduit. The NSW intake chamber is located north of the cooling tower. Additional water is supplied to this conduit from a 3-foot diameter Cooling Tower Makeup Line. One of the two 100 percent capacity NSW pumps (design flow 50,000 gpm) takes suction on the water in the chamber and pumps it through a motor-operated discharge valve and into a 48-inch diameter steel pipe which contains a self-cleaning strainer. This strainer is designed to filter debris down to 1/16-inch diameter and contains isolation and bypass valves to allow maintenance without interruption of NSW flow.

From the strainer, the NSW flows through approximately 1200 feet of 4-foot diameter steel pipe to the power block area of the plant where branch headers go to the Turbine Building, Waste Processing Building, and the Reactor Auxiliary Building. The NSW supply header in the Reactor Auxiliary Building divides to supply the containment non-safety ventilation fan coil units and to ESW safety train A and/or B supply header via a motor-operated isolation valve to provide cooling water to the safety-related components in the Containment Building (i.e., containment fan coolers) and in the Reactor Auxiliary Building. The NSW System supply to ESW Safety train A and/or B is selectable from the main control board in the control room.

During normal operation, the NSW return flows from the branch headers (including the ESW header), with the exception of the Waste Processing Building, are discharged into the circulating water return lines in the Turbine Building north of the main condenser. The return flow from the Waste Processing Building joins the circulating water lines in the yard between the Turbine Building and the Cooling Tower.

Upon the start of an ESW Pump, the NSW supply to the ESW header (that will be supplied by the running ESW Pump) is automatically isolated. In addition, the return flow from the ESW header is automatically realigned to discharge to the Auxiliary Reservoir instead of the Cooling Tower.

The general location of NSW System piping between the plant buildings and the cooling tower is shown in Figure 7.4.

2.2.2 NSW Branch Flow Paths

The NSW supply header splits into four major headers, the ESW supply header A or B, the Turbine Building supply header, the Waste Processing supply header, and the Containment Fan Coil units supply.

The branch flows from the ESW headers are as described in Section 2.1.3.

2.2.2.1 Turbine Building

The Turbine Building service water header is a 24-inch branch off the main 48-inch normal service water supply line. The branch flow paths to the larger Turbine Building heat exchangers contain air-operated temperature control valves that throttle the service water to maintain the shell side fluid at the proper temperature. These loads are as follows:

1. Turbine Lube Oil Coolers
2. Turbine Generator Hydrogen Coolers
3. Hydrogen Seal Oil Unit
4. Air Compressor Aftercoolers (No air-operated TCV)
5. Generator Exciter Cooler
6. Turbine DEH Unit Coolers

There are also a number of small heat exchangers in the Turbine Building which have manual throttle/isolation valves to control the service water flow. These loads are as follows:

1. Condensate Pump Motor Oil Coolers
2. Condensate Booster Pump and Hydraulic Coupling Oil Coolers
3. Heater Drain Pump Motor Oil Coolers
4. Main Feed Pump Oil Coolers
5. Main Generator Bus Duct Cooling Unit
6. Condenser Vacuum Pump Heat Exchangers

The Turbine Building service water header also supplies makeup water to the condensate polisher area evaporative air cooler.

2.2.2.2 Waste Processing Building

The Waste Processing Building service water header is a 24-inch branch off of the main NSW supply line. The major flow demand on this header is the Waste Processing Building closed Cooling Water heat exchanger. There is no automatic temperature control of the shell side fluid of this heat exchanger. Manual butterfly valves are provided for service water throttling/isolation.

The Waste Processing Building HVAC chiller condenser is also supplied with service water cooling from this header. The service water components and controls for this equipment are described in the Waste Processing Chilled Water System Description (SD-146). The Waste Processing Building service water header also supplies makeup water to the Waste Processing Building evaporative air coolers.

2.2.2.3 Containment Fan Coil Units

The branch flows to the Containment Fan coil units contain Containment isolation valves in both the supply and return lines. These valves are remote, air-operated, butterfly valves that automatically shut on a Phase A containment isolation signal.

2.2.3 NSW Interconnections

The NSW System provides a backup source of water to the ESW headers, as described in Section 2.1.1.

3.0 COMPONENTS

3.1 Emergency Service Water System

3.1.1 Emergency Service Water Pumps

The 1A-SA and 1B-SB Emergency Service Water Pumps are Ingersol-Dresser Model 35LKX-2. They are vertical-turbine, mixed-flow pumps with a closed-impeller arrangement involving two stages with single suction. Designed capacity is 20,000 gpm at 225 ft head; runout is 25,000 gpm at 140 ft; minimum recirculation is 7500 gpm at 300 ft; shut off head is equal to 360 ft. These pumps are nuclear safety class 3 and the motors are class IE. The motors are General Electric 6.9 KV, 1300 horsepower, 885 RPM induction type. Pumps 1A-SA and 1B-SB are powered from 6.9 KV Emergency Bus 1A-SA CUB 9 and 1B-SB CUB 1, respectively. The two pumps are located in the Emerency Service Water and Cooling Tower Makeup Intake Structure.

An unusual feature of these pumps is their setting length. The large difference in reservoir elevation [252' mean sea level (MSL) for the auxiliary reservoir and 220' MSL for the main reservoir] results in a total length from the suction bell to mounting flange of over 70 feet. Minimum submergence of 6 ft over the suction bell is required. The pump bearings are water-lubricated by the pumped fluid. A portion of the ESW screen wash flow is diverted through a cyclone separator to remove particles 100 microns and larger, and then supplied to the pump bearing and seal water system. Refer to OST 1214 & 1215 and calculation SW-0051, Attachment 5, for pump performance data.

3.1.2 Emergency Service Water Self-Cleaning Strainers

The two automatic self-cleaning strainers are nuclear safety class 3 and are manufactured by R. P. Adams Company. They are designed to continuously remove particles 1/16 inch in diameter or larger at a flow rate of 21,500 gpm at 150 psig at 140°F with a 5 psi differential. They are located inside the Emergency Service Water and Cooling Tower Makeup Intake Structure. Each unit is equipped with a controlled automatic strainer backwashing system capable of providing continuous or intermittent backwash of 650 gpm at 20 psid without interruption of the main flow stream. The 1A-SA and 1B-SB strainers are powered from 480V MCC-1A325A COMPT.1E and 480V MCC-1B32SB COMPT.1E, respectively.

3.1.3 Service Water Booster Pumps

The Service Water Booster Pumps are Goulds Model 3405 12X14-12, single-stage, horizontal split case, double-suction, centrifugal pumps with a closed impeller. Their design capacity is 4,250 gpm at 120 ft. head; minimum recirculation is 750 gpm at 150 ft. head; runout is 6500 gpm at 74 ft. head with a shutoff head of 170 ft; and design pressure is 225 psig. The pump is nuclear safety class 3. Their motors, made by Siemens-Allis, are each rated at 480 VAC, 200 horsepower, 1770 RPM, and are safety class IE. They are located on the 236' elevation of the Reactor Auxiliary Building in the vicinity of the component cooling heat exchangers. No special lubrication or cooling systems are required for the pump or motor bearings. The booster pumps 1A-SA and 1B-SB are powered from 480V Emergency Busses 1A2-SA and 1B2-SB, respectively. Refer to OST-1214 & 1215 and calculation SW-0051, Attachment 5, for pump performance data.

3.1.4 ESW System Valves

The majority of 4-inch and larger valves installed in ESW piping are carbon steel, lug-body butterfly valves, manufactured by Jamesbury Valve Company. However, several of the most critical valves have been replaced with stainless steel wafer type valves manufactured by Anchor/Darling. Some of the check valves have been replaced with stainless steel valves manufactured by Atwood & Morrill. For 2-inch and smaller diameter ESW piping, the majority of the valves are manufactured by Yarway or Rockwell International; these valves are predominantly globe valves.

3.2 Normal Service Water System

3.2.1 Normal Service Water Pumps

The Normal Service Water Pumps are Peerless Model 48HH and are not nuclear safety related. They are two-stage, vertical-turbine, mixed-flow pumps with closed impellers. The design capacity is 50,000 gpm at 203 ft. head; runout capacity is 72,000 gpm at 72 ft. head; the minimum continuous flowrate is 17,500 gpm (reference 8.4.1); and the minimum submergence is 8'3". The motors are induction motors made by Siemens-Allis and are rated at 6.6 KV, 3,000 horsepower, and 712 RPM. Two 100 percent capacity pumps are located on the Normal Service Water Intake Structure next to the Cooling Tower.

3.2.2 Normal Service Water Self-Cleaning Strainer

The NSW self-cleaning strainer is a Zurn Industries Model 596. Its design flow rate is 50,000 gpm at 150 psig at a temperature of 140°F. The maximum expected pressure differential across the 1/16-inch screen (clean)is 2.5 psid. The strainer is located outdoors on the NSW intake structure. The strainer is equipped with a controlled automatic strainer backwashing system capable of providing backwash of 1630 gpm without interrupting the main flow stream. The strainer is backwashed on a timed cycle. The strainer will also be automatically backwashed between the timed backwashes if a high differential pressure across the strainer is experienced. The backwash motor, made by General Electric, is rated at 480VAC, 2 horsepower, 1725 RPM, and has a final backwash shaft speed of 3.83 RPM.

Corrosion protection for the strainer internals is provided by sacrificial anodes. These anodes have been known to break loose and cause a clanking noise in the vicinity of the strainer.

4.0 OPERATIONS

4.1 Normal Operation

4.1.1 Normal Service Water System

During normal plant operations the Normal Service Water System has one pump supplying the Normal Service Water System and the Emergency Service Water System. This pump supplies the Turbine Building, Waste Processing Building, Containment Fan Coil units, and Emergency Service Water System headers.

4.1.2 Emergency Service Water System

During normal plant operations the Emergency Service Water System is in a standby mode except as described in Section 2.1.1. The pumps are not running, but the system headers and loads are lined up to be supplied by the NSWS. Typically, both ESW headers are in service to minimize stagnant conditions and provide chemical treatment for biological control. The supply and return valves for the header(s) in service are open. If one ESW header is placed in standby, the supply valve for the idle header is open and the return valve is shut in order to keep the idle header pressurized.

4.2 Start-Up and Cooldown

4.2.1 Normal Service Water System

Most start-ups and cooldowns can be accomplished with the Normal Service Water System supplying both Normal Service Water System and Emergency Service Water System loads. However, if a rapid cooldown is desired (primary system), the second Normal Service Water System Pump and the second safety-related service water header must be placed in service. This is because two component cooling water heat exchangers are needed and because flows through the other normal service water loads are assumed to be close to the respective design flows.

Dry start-up of the NSW system requires special valve line-ups to avoid water-hammer damage. Current operating procedures require the isolation of the WPB supply header, turbine generator exciter coolers, and turbine generator hydrogen coolers. An automatic priming mode also helps prevent water-hammer. This is initiated by taking the pump start switch to START and quickly releasing. In this mode, the NSW pump discharge valve opens 10 percent for seven minutes. After seven minutes the valve fully opens.

If one pump is already running at normal flow and pressure and the second pump is to be started, the automatic priming mode may be bypassed by holding the pump start switch in the START position. In this mode the discharge valve can be taken full open, bypassing the seven-minute hold point.

Each NSW pump has "anti-pump" protection in the starting logic. Once the control switch is taken to START (either in priming or in priming-bypass mode), the sequence to close the pump breaker begins and cannot be restarted for at least 15 seconds. Any attempt to restart the pump within the 15-second period is blocked. This logic is intended to prevent multiple, rapid closures of the pump breaker, such as might occur with a breaker fault.

4.2.2 Emergency Service Water System

During start-ups and cooldowns the Emergency Service Water System remains in a standby condition with Normal Service Water supplying the loads of the Emergency Service Water headers. If a rapid cooldown of the primary systems is desired, both A and B headers are placed in service to supply the two component cooling water heat exchangers.

4.3 Abnormal Operations

4.3.1 Normal Service Water System

Whenever service water temperature exceeds 90°F, all four containment fan coolers are placed in service. The second Normal Service Water Pump may be needed if the other loads are drawing close to design flows. The second Emergency Service Water Header must be placed in service due to the containment fan coolers. Loss of normal service water will result in plant shutdown due to loss of cooling to essential secondary components.

4.3.2 Emergency Service Water System

This safety-related system is required to be operable to support cooling requirements following an accident (LOCA, loss of off-site power). If this should happen the Emergency Service Water System will isolate from the Normal Service Water System, the pumps start automatically, and valves cycle to their safeguards positions.

The Technical Specification Minimum Main Reservoir level is 215 feet. This limit is to insure that all components are capable of their design basis heat removal capacities.

If the Emergency Service Water intake water temperature falls below 35°F, the Emergency Service Water pumps should be started to minimize the potential for icing the Emergency Service Water intake.

The Emergency Service Water pumps and booster pumps are operated on a periodic basis to ensure proper flows in accordance with the Technical Specifications surveillance requirements.

It should be noted that nearly all of the ESW heat loads do not contain automatic throttling valves for temperature control of the shell side fluid. This situation makes it necessary to conduct a flow balance to determine the position of the manual heat exchanger outlet valves, such that proper service water flows are maintained in the system.

4.4 Technical Specifications

At least two independent Emergency Service Water loops shall be OPERABLE.

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

5.1.1 Emergency Service Water System

The following systems are required for support of the Emergency Service Water System:

1. Instrument Air for valve operation
2. Emergency Service Water Screen Wash System and Emergency Service Water Traveling Screens
3. Reservoirs, Intake Canals and Structures, Discharge Canals and Structures
4. Various electrical systems

5.1.2 Normal Service Water System

The following systems are required for support of the Normal Service Water System:

1. Instrument Air for valve operation
2. Potable Water for pump bearing and seal flushing
3. Circulating Water for return of the service water to the cooling towers
4. Cooling Tower and Cooling Tower Makeup System
5. Various electrical circuits and panels

5.2 System-to-System Crossties

The ESW System is cross-connected with the NSW System, the Auxiliary Feedwater System, and the Fire Protection System.

6.0 TABLES

6.1 Typical Service Water Loads by Building

Table 6.1

Typical Service Water Loads by Building

<u>Normal Service Water</u>

WASTE PROCESSING BUILDING HEADER	LOAD (gpm)
Waste Processing Bldg. Component Cooling Water Heat Exchangers	10,000
Waste Processing Bldg. Chiller Condenser	5,200
Waste Processing Bldg. Evaporative Air Cooler	
CONTAINMENT / RAB	
Containment Air Handling Units (AH 37, 38, 39)	2,400
Makeup to RAB Evaporator Air Coolers (Auto Isolation on SIAS)	10
TURBINE BUILDING HEADER	
Turbine Building Header	11,032
Turbine Lube Oil Cooler	3,500
Generator Hydrogen Cooler	4,500
Hydrogen Seal Oil Coolers	360
Condensate Booster Pump Hydraulic Coupling and Motor Coolers	600
Condensate Vacuum Pump Coolers	354
Main Generator Leads Cooler (Isolated Bus Duct Coolers)	230
Main Feed Pump Oil Coolers	30
Condensate Pump Motor Coolers	34
Turbine Bldg. Evaporator Air Coolers	20
Turbine Electrohydraulic Control System Coolers	20
Air Compressor Aftercoolers	45***
Heater Drain Pump Motors	27
Generator Exciter Coolers	300
Radiation Monitor Coolers	60

<u>Emergency Service Water</u>*	LOAD PER TRAIN (gpm)
Boron Thermal Regeneration System Chillers NNS	414
Air Compressor Aftercoolers (Normally from NSWS Emergency can be ESWS)	45***
ESCWS Chiller Condenser	2,500
Containment Air Coolers Air Handling Units	3,000
Component Cooling Water System Heat Exchanger	11,000
Diesel Generator Jacket Water Cooler	1,000
Charging and Safety Injection Pumps Oil Cooler	60
Emergency Makeup to Motor-Driven AFW Pump	900
Emergency Makeup to Turbine-Driven AFW Pump	900
Emergency Service Unit Intake Screen Wash Pump	270
ESWS Strainer Backwash	650
PASS Cooler	**87

* Values are approximate based on system flow balance & design data. Reference calcs SW-0078 & SW-0080 for min. flow limits.
** From DBD-139.
*** 45 gpm is for all 3 aftercoolers.

7.0 FIGURES

7.1 Emergency Service Water System, Train A

7.2 Emergency Service Water System, Train B

7.3 Normal Service Water System

7.4 Service Water System Yard Piping

7.5 NSW Bearing Lubrication and Motor Cooling

7.6 ESW Pump Seal/Bearing Water

Figure 7.1

Emergency Service Water System, Train A

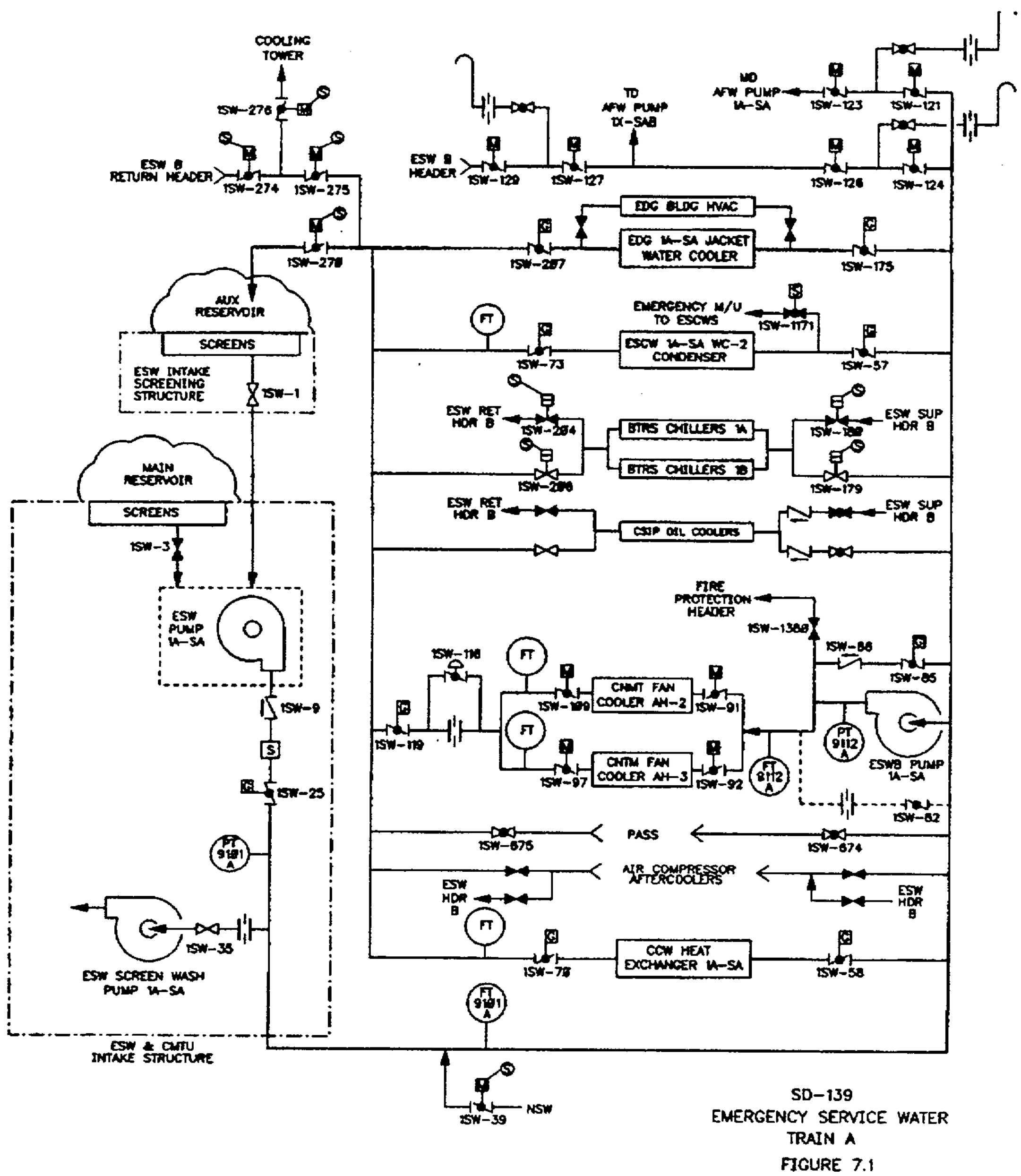


Figure 7.2
Emergency Service Water System, Train B

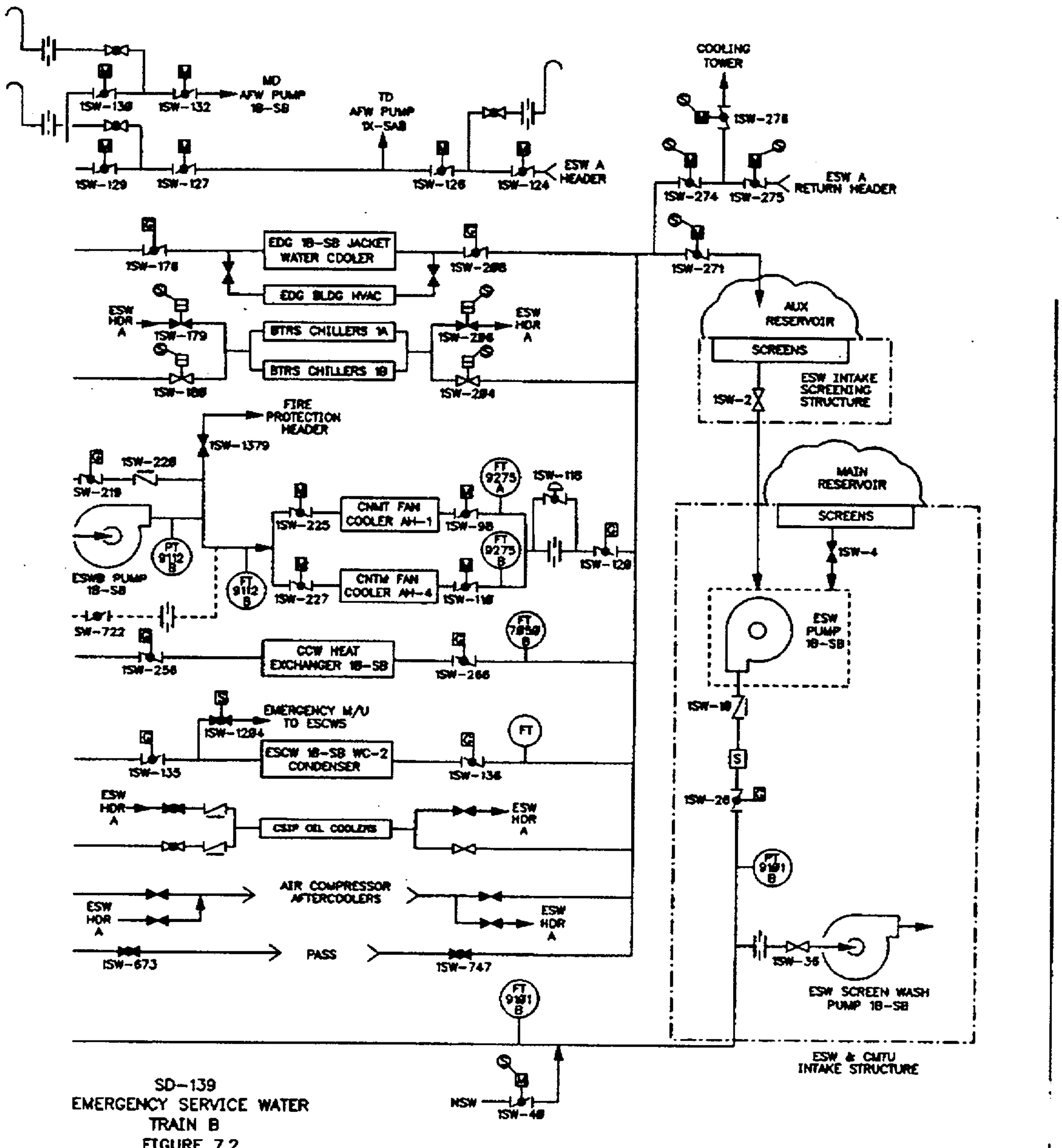


Figure 7.3

Normal Service Water System

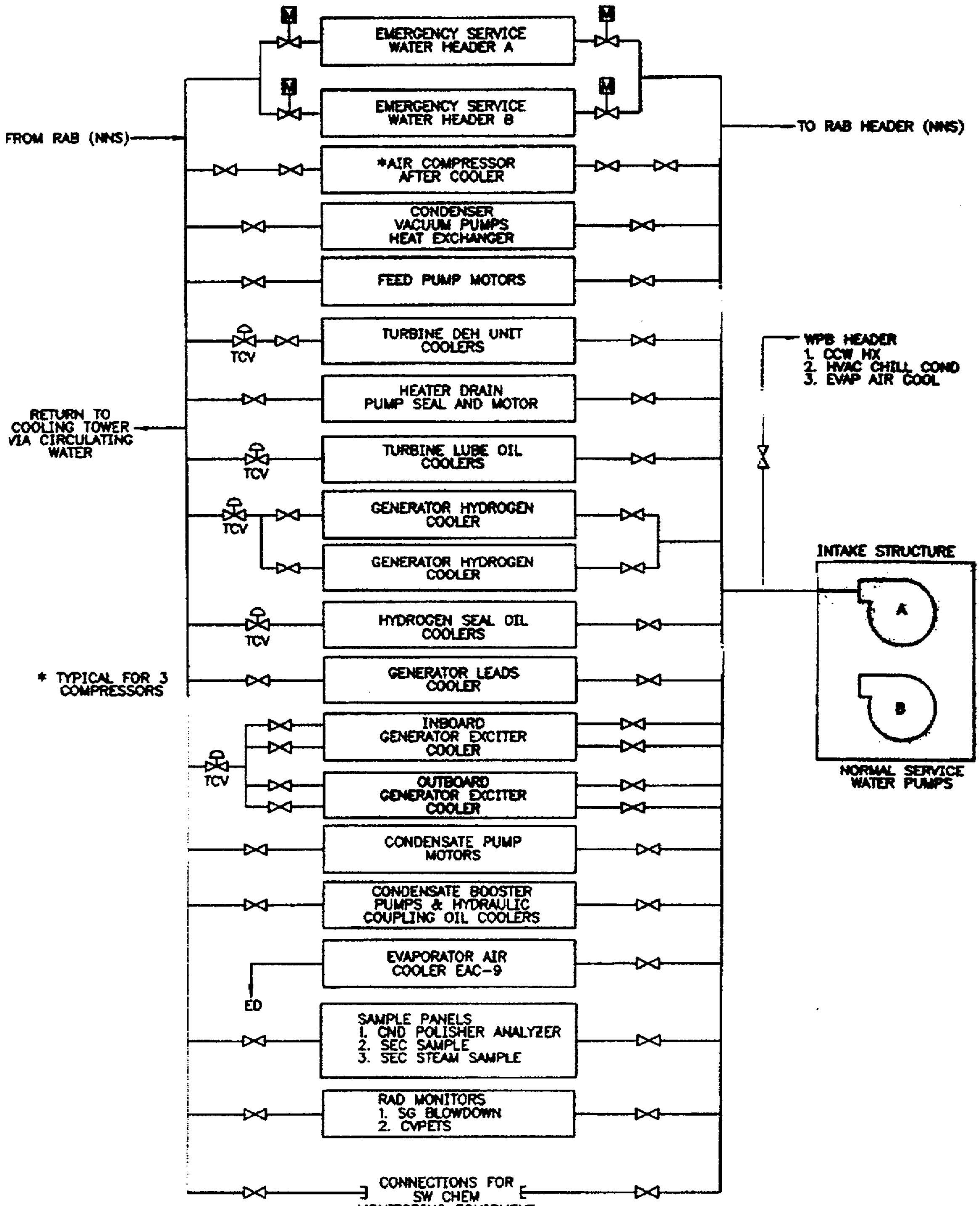


Figure 7.4

Service Water System Yard Piping

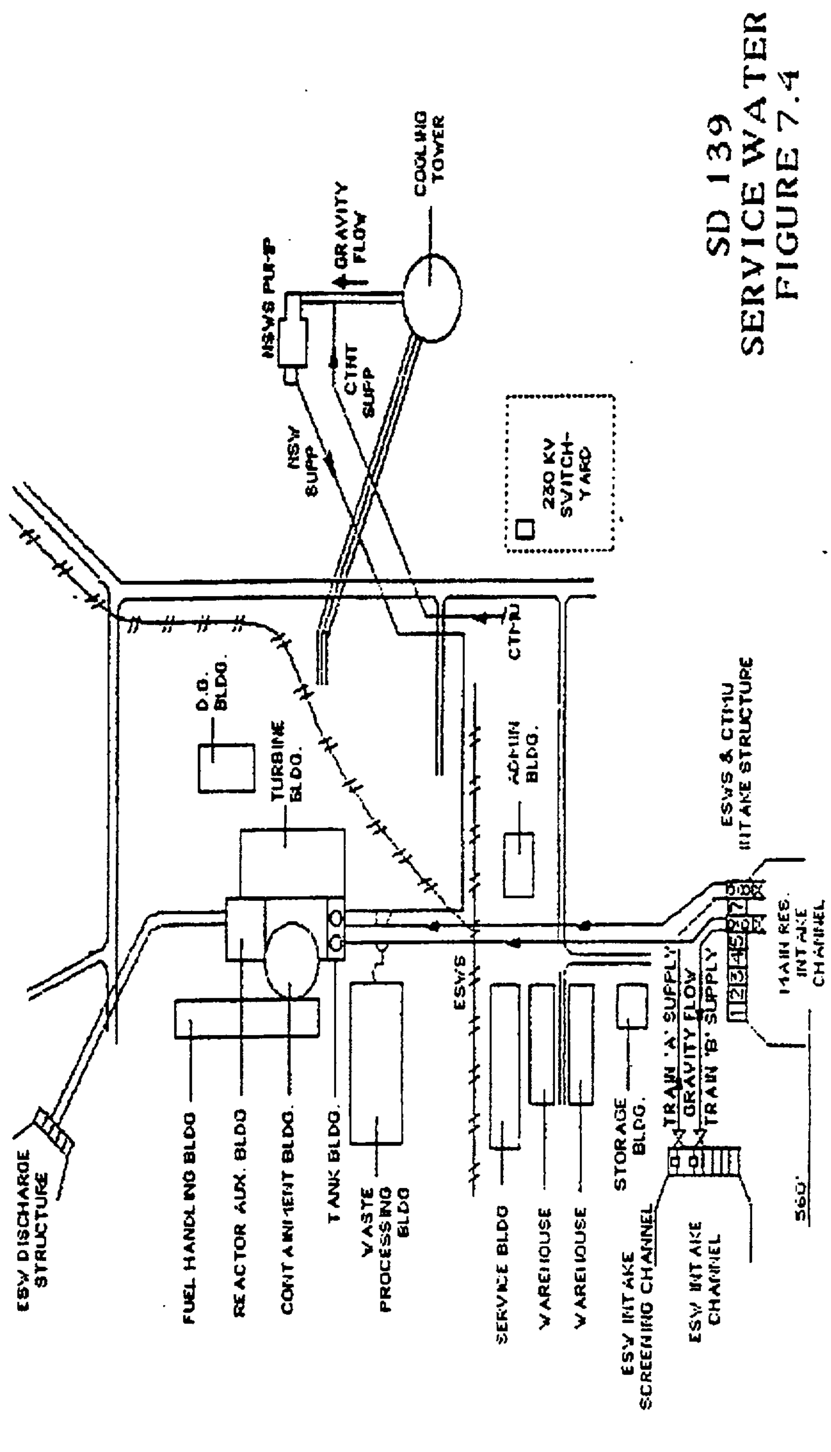


Figure 7.5

NSW Bearing Lubrication and Motor Cooling

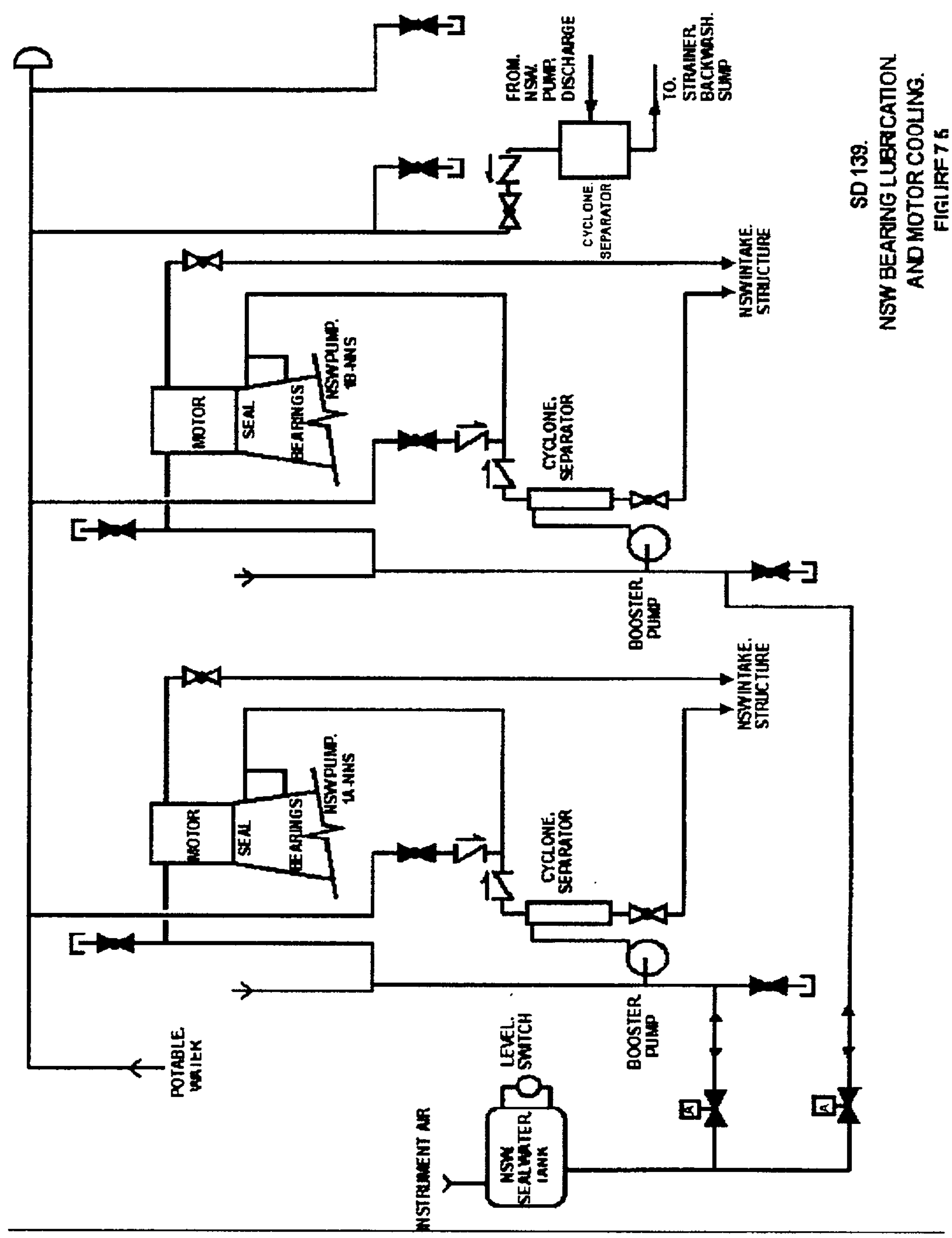
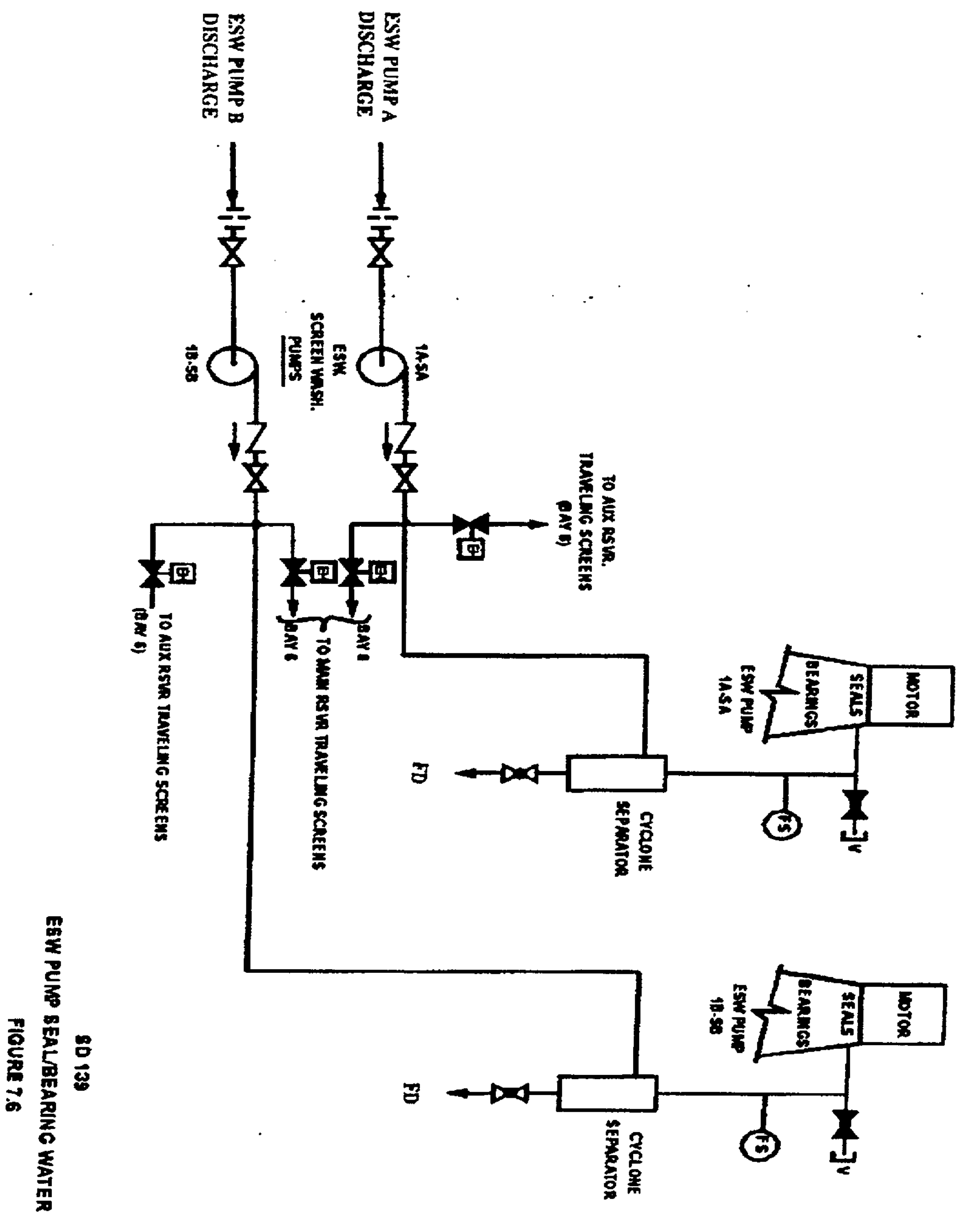


Figure 7.6
ESW Pump Seal/Bearing Water



8.0 REFERENCES

8.1 Drawings

8.1.1 System Drawings

Drawing Number	Title
2165-G-047	Flow Diagram - Circulating and Service Water System, Sheet 1, Unit 1
2165-G-048	Flow Diagram - Circulating and Service Water System, Sheet 2, Unit 1
2165-G-436	Flow Diagram - Intake Structures Pump Seal, Bearing Lubrication and Motor Cooling Water Systems
2165-G-876	Flow Diagram - Cooling Water System for Waste Processing Building, Sheet 1
2165-G-133	Flow Diagram - Diesel Generator Systems, Unit 1
2165-S-0547	Simplified Flow Diagram - Circulating and Service Water Systems, Sheet 1, Unit 1
2165-S-0548	Simplified Flow Diagram - Circulating and Service Water Systems, Sheet 2, Unit 1
2165-S-0936	Simplified Flow Diagram - Intake Structures Pump Seal, Bearing Lubrication and Motor Cooling Water Systems, Unit 1
2165-S-1376	Simplified Flow Diagram - Cooling Water System for Waste Processing Building, Sheet 1, Unit 1
2165-S-0633	Simplified Flow Diagram - Diesel Generator Systems, Unit 1
2166-G-425S01	Service Water Pumps, Discharge Header Valves and Service Water Booster Pumps Instrument Schematics and Logic Diagram, Unit 1
2166-G-425S02	Service Water Pumps, Discharge Header Valves and Service Water Booster Pumps Instrument Schematics and Logic Diagram, Unit 1
2168-G-497S02	HVAC - Non-Essential Chilled Water - Condenser Flow Diagram - WPB
2168-G-498S02	HVAC - Essential Services Chilled Water -Condenser Flow Diagram - Unit 1 - SA
2168-G-499S02	HVAC - Essential Services Chilled Water -Condenser Flow Diagram - Unit 1 - SB

8.1.2 Control Wiring Diagrams

Drawing Number	Sheet	Title
2166-B-401		
	2181	NSW Pump 1A-NNS Sheet 1
	2182	NSW Pump 1B-NNS Sheet 1
	2183	NSW Pumps Instrumentation
	2185	NSW Pump 1A Dischg. Valve 7SW-B37-1
	2186	NSW Pump 1B Dischg. Valve 7SW-B38-1
	2188	NSW Pumps Strainer 7SW-S23-1 & Va. 7SW-H1-1
	2189	NSW Pump 1A-NNS Sheet 2
	2190	NSW Pump 1B-NNS Sheet 2
	2191	NSW Seal & Brg. Clg Wtr Booster Pump 1A-NNS
	2192	NSW Seal & Brg. Clg Wtr Booster Pump 1B-NNS
	2197	Exciter Cooler Outlet Valve (TCV-0951)
	2198	Hydrogen Cooler Outlet Valve (TCV-0950)
	2199	H2 Seal Oil & DEH Cooler Instrumentation
	2201	Turbine Lube Oil Coolers Outlet Valve (TCV-4750)
	2202	Turbine Gen. Cooler Valves Indication
	2207	NSW Supply Hdr "A" Isol. Valve 3SW-B5SA-1
	2208	NSW Supply Hdr "B" Isol. Valve 3SW-B6SB-1
	2211	ESW Pump 1A-SA
	2212	ESW Pump 1B-SB
	2213	ESW Pumps Instrumentation
	2216	ESW Pump 1B-SB Inlet Va. - Main Reservoir - 3SW-B4SB-1 & Aux. Reservoir 3SW-B2SB-1
	2217	ESW Pump 1A-SA Inlet Va. - Main Reservoir - 3SW-B3SA-1 & Aux. Reservoir 3SW-B1SA-1
	2220	Main Reservoir Level Instrumentation

8.1.2 Control Wiring Diagrams (continued)

Drawing Number Sheet	Title
2221	ESW Pump 1A-SA Strainer 3SW-S21SA-1 & Valve 3SW-H2SA-1
2222	ESW Pump 1B-SB Strainer 3SW-S22SB-1 & Valve 3SW-H3SB-1
2223	ESW Pump 1A-SA Dischg. Valve 3SW-B7SA-1
2224	ESW Pump 1B-SB Dischg. Valve 3SW-B9SB-1
2227	Service Water Sys. "A" Misc. Alarms Sh. 1
2228	Service Water Sys. "B" Misc. Alarms Sh. 2
2229	Service Water Sys. "A" & "B" Misc. Alarms, Sh. 3
2231	Service Water System "A" Misc. Alarms, Sh. 4
2232	Service Water Sys. "B" Misc. Alarms, Sh. 5
2233	Service Water Booster Pump 1A-SA
2234	Service Water Booster Pump 1B-SB
2235	Service Water Booster Pumps Instrumentation (Pressure & Flow)
2237	Contmt. Service Water "A" & "B" Return Orifice Bypass Valves 3SW-B64SA-1 & 3SW-B65SB-1
2241	Serv. Water from Containment Fan Coolers AH-2 (SA) & AH-3 (SA) Instrumentation
2242	Serv. Water from Containment Fan Coolers AH-1 (SB) & AH-4 (SB) Instrumentation
2245	Serv. Water to Containment Fan Cooler AH-3 Inlet Valve 2SW-B46SA-1
2246	Serv. Water from Containment Fan Cooler AH-3 Outlet Valve 2SW-B47SA-1
2247	Service Water to Containment Fan Cooler AH-2 Inlet Valve 2SW-B45SA-1
2248	Service Water from Containment Fan Cooler AH-2 Outlet Valve 2SW-B49SA-1

8.1.2 Control Wiring Diagrams (continued)

Drawing Number Sheet	Title
2249	Service Water to Containment Fan Cooler AH-1 Inlet Valve 2SW-B52SB-1
2250	Service Water from Containment Fan Cooler AH-1 Outlet Valve 2SW-B48SB-1
2251	Service Water to Containment Fan Cooler AH-4 Inlet Valve 2SW-B51SB-1
2252	Service Water from Containment Fan Cooler AH-4 Outlet Valve 2SW-B50SB-1
2253	Service Water to Containment Fan Coil Units Isol. Va. 2SW-B88SAB-1
2254	Service Water Return from Containment Fan Coil Units Isol. Valve 2SW-B89SA-1
2255	Service Water Return from Containment Fan Coil Units Isol. Valve 2SW-B90SB-1
2257	Hdr. "A" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B70SA-1
2258	Hdr. "A" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B71SA-1
2259	Hdr. "B" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B73SB-1
2260	Hdr. "B" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B72SB-1
2261	SW Backup to AFWP 1A-SA Supply Valve 3SW-B75SA-1
2262	SW Backup to AFWP 1A-SA Supply Valve 3SW-B74SA-1
2263	SW Backup to AFWP 1B-SB Supply Valve 3SW-B77SB-1
2264	SW Backup to AFWP 1B-SB Supply Valve 3SW-B76SB-1
2267	SW to & from Component Clg. Wtr. HX "A" Instr. & Alarms

8.1.2 Control Wiring Diagrams (continued)

Drawing Number Sheet	Title
2268	SW to & from Component Clg. Wtr. HX "B" Instr. & Alarms
2272	Serv. Wtr./CVCS Chiller Isolation Valves 3SW-V266SA-1 & 3SW-V237SA-1
2273	Serv. Wtr./CVCS Chiller Isolation Valves 3SW-V267SB-1 & 3SW-V238SB-1
2280	"A" Service Water Hdr. Return to Normal Service Water Hdr. 3SW-B13SA-1
2282	"B" Service Wtr. Hdr. Return to NSW Hdr. 3SW-B14SB-1
2284	Reactor Aux. Bldg. Return SW Main Hdr. Isolation Valve 3SW-B8SB-1
2286	Service Water Return Hdr. A Shutoff Valve to Aux. Reservoir 3SW-B15SA-1
2287	Service Water Return Hdr. B Shutoff Valve to Aux. Reservoir 3SW-B16SB-1
2290	Service Water Manual Return Valve 7SW-B53-1 Indication
2451	Air Compressor 1A-NNS
2598	Chiller WC-2 (1A-SA) Chilled Water Alarms, Sh. 1
2599	Chiller WC-2 (1B-SB) Chilled Water Alarms, Sh. 1
2601	Chiller WC-2 (1A-SA) Compressor, Sh. 1
2605	Chiller WC-2 (1A-SA) Condenser Water Recirculating Pump P7 (1A-SA)
2612	Chiller WC-2 (1A-SA) Condenser Water Supply Valve 3SW-B300SA-1
2617	Water Chiller WC-2 (1A-SA) Emergency Makeup Water Supply Valve 3SW-V868SA-1

8.1.3 SW System Component Instr. Schematics and Logic Diagrams

Drawing Number	Sheet	Title
2166-B-430		
	13.1	DEH & Lube Oil Coolers
	13.2	Hydrogen Seal Oil Coolers
	13.3	Hydrogen & Exciter Coolers
	21.1	Serv. Wtr. for Aux. F. Wtr. Pumps
	21.2	Serv. Wtr. to & from Comp. Clg. Wtr. HX
	21.3	Serv. Wtr. to & from Containment Fan Coolers AH-2&3
	21.4	Serv. Wtr. to & from Containment Fan Coolers AH-1&4
	21.5	Serv. Wtr. to & from Air Compressors & Aftercoolers
	21.7	Serv. Wtr. to & from Containment Fan Coil Units
	21.12	Serv. Wtr. to Aux. Bldg HVAC Chillers WC-2

8.1.4 Manufacturer's Drawing

Drawing Number	Title
1364-3957	ESW Self-Cleaning Strainer Control Panel
1364-4553	Dresser Instruments - Thermometer, Model 50EI60E
1364-5229	Masoneilan Int'l - Pneumatic Actuator Models 33-37310 & 8005A
1364-5899	Valtek - Mark I Valve Actuators
1364-4010	Rosemount - Pressure Transmitter, Model 1153B
1364-4009	Rosemount - Temperature Transmitter, Model 444
1364-6431	Weed Instr. - Thermocouple Type E4B250G-(L)AS
1364-4178	Mercoid - Pressure Switch Model DAW-7043-804B
1364-4761	Mercoid - Pressure SW Diff., Model DPAW-7033-804B
1364-2127	Versa Pac Motor Outline - NSW Pump
1364-3189	Siemens-Allis - SW Bstr. Pump
1364-1996	Weston - Temperature Gage, Models 4300 & 4310

8.1.4 Manufacturer's Drawing (continued)

Drawing Number	Title
1364-16589	General Electric - ESW Pump Motor
1364-2900	Jamesbury Valve - 30" Wafer Sphere 150# Flanged
1364-5201	Pyco - Temperature Gages Model 23-7156
1364-41808	United Electric - Press. Diff. SW Model J27KB
1364-4763	Pyco - Temperature Ind. SW. - Model 23-7148
1364-96530,S01,S02	Anchor/Darling Valve - 30" Wafer Butterfly, 150#
1364-96531,S01,S02	Anchor/Darling Valve - 36" Wafer Butterfly, 150#
1364-7370	ESW Pump General Arrangement Dwg.
1364-43477	ESW Pump Cross-Sectional Dwg.
1364-43475	ESW Pump BOM
1364-43476	ESW Pump Spare Parts
1364-96537	ESW Pump Lower Seismic Support
1364-45840	ESW Pump 1A-SA Performance Curve
1364-45839	ESW Pump 1B-SB Performance Curve
1364-98013	Wafer Check Valve 14 inch 150 LB. SS
1364-98014	Wafer Check Valve 30 inch 150 LB. SS

Notes:

1. The drawing number listed is not applicable to all applications of the instrument in the Service Water System. Consult the Instrument List for the applicable EMDRAC drawing number.

8.2 Specifications

Specification No.	Title
IN-01	Electronic Instrumentation
IN-03	Orifices
IN-04	Thermocouple Assemblies
IN-07	Local Pressure Gages

8.2 Specifications (continued)

Specification No.	Title
IN-08	Local Dial Thermometers
IN-09	Temperature Switches
IN-10	Pressure Switches
IN-33	Level Transmitters
IN-35	Low Range Flow Switches
M-12	Miscellaneous Pumps
M-32P	2 1/2 Inch & Larger Valves
M-34	2 Inch & Smaller Valves
M-44	Butterfly Valves
M-49M	Strainers
M-60	Self-Cleaning Strainers
M-66	Miscellaneous Control Valves
M-67H	NSW & Clg Twr M/U Pumps
M-67P	ESW Pumps
M-78	ESW Intake Structure Butterfly Valves
E-13	Auxiliary Motors
CPL-HNP1-M-029	Emergency Service Water Butterfly Valves

8.3 Technical Manuals

Equipment Name	Manual	Manufacturer
Emergency S. W. Pumps	KIS	Hayward Tyler
ESW Self-Cleaning Strainer	JCE	R. P. Adams Co., Inc.
SW Booster Pumps	BHQ	Gould Pumps, Inc.
ESW Pump Motor	IJX	General Electric
SW Booster Pump Motor	IJU	Siemens-Allis
NSW Flushing Wtr. Bstr Pump	IJR	Peerless
NSW Flushing Wtr. Bstr Pump Motor	IJR	Peerless

8.3 Technical Manuals (continued)

Equipment Name	Manual	Manufacturer
NSW Pump	IJR	Peerless
NSW Pump Motor	IJU	Allis-Chalmers
SW Sys. Check Valves	BIV	TRW Mission
Masoneilan Control Valves	BJW	Masoneilan
2" & Smaller Valves	BKP	Yarway
2" & Smaller Valves	NWD, BKK	Rockwell Int'l
Misc. Butterfly Valves (ESW & NSW)	BKG	Jamesbury Corp.
NSW Self-Cleaning Strainer	BHY	Zurn
ESW-2 1/2" & Larger Valves	BKA	Pacific
30" and 36" Butterfly Valves	BKB	Anchor/Darling

8.4 Other References

8.4.1 ESR 97-00321, "Minimum Flow for NSW Pumps."

Revision Summary

Revision 12 - Revised per ESR 99-00145

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CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description (SD)

NUMBER: SD-102

TITLE: Primary Makeup System

REVISION 5

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1.0 SYSTEM PURPOSE

The Primary Makeup System (PMS) portions of which are safety-related, is designed to supply makeup water to the following systems:

1. Waste Processing System (WPS)
2. Component Cooling Water System (CCWS)
3. Chemical and Volume Control System (CVCS)
4. Reactor Coolant System (RCS)
5. Filter Backwash System (FBS)
6. Boron Recycle System (BRS)
7. Primary Sampling System (PSS)

2.0 FUNCTION

CAUTION

Setpoints given in this SD are for reference only. Actual values should be obtained from a controlled setpoint document.

The PMS is composed of the Reactor Makeup Water Storage Tank (RMWST), two Reactor makeup water pumps, and the associated valves instrumentation, and piping.

The RMWST serves as the head tank for the Primary Make up System. The tank incorporates a diaphragm and nitrogen sparging system to minimize the amount of dissolved oxygen present in the primary makeup water. Level is monitored by level indicators and by low and high level alarms in the MCR. Makeup water is provided by the Demineralized Water System. Two other potential sources of makeup water for the RMWST are the Boron Recycle Monitor and Waste Evaporator Condensate Tanks. The automatic level control is isolated because of leakby. This valve may be unisolated to manually fill the RMWST to maintain the level in the tank within design limits.

Two (one hundred percent capacity) Reactor makeup water pumps take suction on the RMWST and supply primary makeup water to all users as indicated on Figure 7.1 through 7.3. One pump is normally in continuous operation to supply makeup to said users at all times. The alternate pump is maintained in automatic, in anticipation of a start signal from the CVCS reactor makeup control system (RMCS). (The RMCS provides for the actual makeup to the Reactor Control System. See SD-107 for details on the RMCS.) Minimum flow recirculation lines extend from the pump discharges to the RMWST. These lines protect the pumps during periods of low flow demand on the primary makeup system.

Pneumatically operated, fail-closed valves provide for the remote isolation of the safety-related portion of the PMS (that portion which serves RCS makeup needs) from the miscellaneous nonsafety-related users.

3.0 COMPONENTS

3.1 Reactor Makeup Water Storage Tank (RMWST)

The 85,000 gallon RMWST provides for storage of the demineralized water used by the PMS. The tank is fabricated of type 304 stainless steel is 27 feet in diameter, and stands 20 feet tall.

The RMWST is fitted with a diaphragm which drapes the tank sides and covers the surface of the contained water volume to exclude air. A gooseneck vent is provided above the diaphragm to allow it to rise and fall with water level. Below the diaphragm, an overflow line is installed which extends inside the tank to just above its floor. This extension prevents the diaphragm from blocking the overflow path. Outside the tank a loop seal is employed, which when kept full with water, deters air from entering the tank. The overflow line spills into an open funnel at the top of the tank, thus preventing siphoning. Also, the overflow pipe extension inside the tank is drilled at one foot intervals with ½ inch holes. This is to prevent rising or falling water levels from expelling the water from the loop seal. Operators can periodically makeup to the loop seal with demineralized water to replenish any loss due to evaporation.

A nitrogen sparger is installed in the RMWST for sparging any dissolved oxygen that may find its way into the system. The sparger consists of three headers which are mounted on the tank floor and are arranged 90° apart. The quadrant of the tank which includes the pump suction line does not contain a header. This is to preclude the possibility of nitrogen induced pump cavitation.

The sparging flowpath is completed by four relief valves which are equally spaced at the top of the tank, just under the diaphragm. These relief valves act as pressure control valves, relieving at 2 INWC. The tank is also provided with a code safety valve which ultimately protects the tank from over pressurization.

3.2 Reactor Makeup Water Pumps

The Reactor Makeup Water Pumps are located on the 236' elevation of the tank building and take their suction from the RMWST. The pumps are horizontal centrifugal types and are designed to supply 150 gpm of water at a TDH (Total Dynamic Head) of 250 feet. Control of both pumps is provided by two three-position selector switches on the MCB in association with the Reactor Makeup Control System of the CVCS. The Reactor Make-up Water Pumps 1A-SN and 1B-SN are powered from 480 V MCC-1A24 Compt. 4D and 480 V MCC-1B24 Compt. 3D, respectively. The Reactor Makeup Water Pumps are Crane Chempumps, Model GVE-20K-23H-1S.

3.3 Control Valves

3.3.1 Level Control Valve 1DW-8

The RMWST level control valve (1DW-8) is a 3-inch air operated globe valve. It is located on the north wall of the tank building next to the RMWST. Control power is provided by circuit 6 of 120 VAC power panel 1D212.

3.4 Isolation Valves

Primary Makeup isolation valve 1PM-30 and RAB isolation valve 1PM-60 are controlled and indicated from the desk section of the Main Control Board Panel 1A2. They are both quality class "A" and subject to In Service Inspection. They are pneumatically operated and fail closed on loss of air.

3.4.1 1PM-30

1PM-30 is a 4-inch flex wedge gate valve manufactured by the Anchor Darling Valve Co. Control power is supplied from circuit 6 of 120 VAC power panel 1D212. This valve is located near row-column D-15 on the 236' elevation of the RAB.

3.4.2 1PM-60

1PM-60 is a 4-inch flex wedge gate valve manufactured by the Anchor Darling Valve Co. Control power is supplied from circuit 6 of 120 VAC power panel 1D212. This valve is located near row-column D-42 on the 262' elevation of the RAB.

4.0 OPERATIONS

CAUTION

Setpoints given in this SD are for reference only. Actual values should be obtained from a controlled Setpoint document.

4.1 Normal Operation

The PMS is normally in operation during all modes of plant operations. One pump is kept in operation while the other is maintained in automatic. During modes 5 and 6 one pump is held under a Shift Supervisor's clearance. Each pump is designed to operate continuously, recirculating a minimum amount of water back to the RMWST. Once started, the system requires no further operator action other than periodically switching the Reactor Makeup Water Pumps (to provide even run time).

4.2 Oxygen Excursions

In the event that dissolved oxygen levels in the RMWST becomes too high, two corrective actions are available. For extreme excursions the tank can be completely bypassed via pressure control valve 1DW-497 (manual opening and closing of isolation valves is required). See Figure 7.1. This pressure control valve is set to maintain the proper available suction head to the makeup pumps. Note that while in bypass, miniflow is provided by each pump's discharge drain line. Another method of averting oxygen excursions through nitrogen sparging. This is accomplished by manually throttling nitrogen flow to the RMWST as locally indicated by FI-8092. The two methods may be applied in combination as well as individually.

NOTE: The bypass may also be used when maintenance on the RMWST is required.

4.3 Special Interlocks and Controls

4.3.1 Automatic Operation by CVCS

In addition to manual operation, the Primary Makeup System can be triggered automatically by the CVCS. In the event that automatic makeup to or dilution of the Reactor Coolant System is required, the CVCS Reactor Makeup Control System will send a signal to both Primary Makeup System Pumps. The pump in operation will continue to run and the second pump, if in auto, will start. When the automatic start signal is removed, the pumps will return to their original operating condition. (See SD-107 CVCS, for more details.)

4.3.2 Reactor Makeup Water Storage Tank Level

The Demineralized Water System provides makeup water to the RMWST. LS-8901B1 closes on RMWST "Lo" level and initiates the signal to open valve 1DW-8. 1DW-6 can be opened to provide demineralized water to the RMWST via 1DW-8. LS-8901B2 closes and LS-8901B1 opens on RMWST "Hi" level. This action initiates the signal to shut valve 1DW-8, upon which 1DW-6 can then be shut.

4.3.3 Filter Backwash System

As shown on Figure 7.2, the Primary Makeup System provides water to the Filter Backwash System (FBS). All associated PMS valves are actuated by their respective FBS control panels. The filter backwash isolation valves and their associated operation are discussed in SD-120.2, Filter Backwash System.

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

5.1.1 Demineralized Water System

The Demineralized Water System (DWS) is the major support system of the PMS. The DWS is capable of supplying normal makeup with additional capacity for filling the RMWST.

5.1.2 Boron Recycle System

The Boron Recycle System is also capable of supplying makeup to the PMS. (See SD-109, BRS).

5.2 System-to-System Cross Ties

5.2.1 Component Cooling Water System

The PMS provides an emergency source of makeup water to the CCWS through manual valve 1PM-61. The normal source of water for the CCWS is the Demineralized Water System.

5.2.2 Reactor Coolant System

5.2.2.1 Reactor Coolant Pump Standpipe

The makeup water for the standpipes of the reactor coolant pumps and pressurizer relief tank is supplied through containment isolation valve 1RC-161. The standpipe level instrumentation (all part of CVCS) controls the amount of water taken from the PMS. Makeup water flows from the standpipe, of each Reactor Coolant Pump, into the number 3 seal of the Reactor Coolant Pump between its "double dam" seal area. The makeup water is used as purge water to minimize the buildup of boric acid crystals at the top of the number 3 seal. Purge flow is 2 to 4 gph and drains to the containment sump. (See SD-107, Chemical and Volume Control System.)

5.2.2.2 Pressurizer Relief Tank

The steam and water which is discharged from the various safety and relief valves inside Containment is routed to the pressurizer relief tank. The tank normally contains water with a predominantly nitrogen atmosphere. In order to obtain effective condensing and cooling of the entering steam, the tank is installed horizontally with the steam discharged through a sparger pipe located near the tank bottom and under the water level. The tank is also equipped with an internal spray header and a drain which are used to cool the water following a discharge. Water from the PMS is one source of cooling water which is discharged through the spray header. (See SD-100.3, Pressurizer and Controls.)

5.2.3 Waste Processing System

5.2.3.1 Waste Gas Compressors

Seal water flowing in the loop formed by the compressor, separator, and heat exchanger is derived from the primary makeup system. Makeup water is applied to the compressor inlet through control system elements during start-up and at any time that the level of seal water drops below a predetermined level. (See SD-120.7, Gaseous Waste Processing.)

5.2.3.2 Hydrogen Recombiners

Reactor makeup water is supplied to the recombiners to allow for flushing and decontamination prior to maintenance work being performed. (See SD-120.7, Gaseous Waste Processing.)

5.2.3.3 Waste Evaporator Packages, Waste Reagent Tank

Makeup water provided to the waste evaporator packages serves as: (1) flushing water for lines, concentrator feed pumps, and feed tank; (2) flushing water for concentrator; and (3) flushing water for concentrator level controller. Makeup water is used to mix batches of caustic solution in the reagent tank for addition to the system. (See SD-120, Waste Processing.)

5.2.3.4 Spent Resin Storage Tanks

The purpose of the spent resin storage tanks is to provide a collection point for spent resin to allow for decay of short lived radionuclides before solidification. These tanks serve also as head tanks for the spent resin sluice pumps. Four spent resin storage tanks are provided for the Liquid Waste Processing System. Along with filling of storage tanks, makeup water is used to agitate and pressurize the tanks for sluicing resin. (See SD-120.4 Spent Resin Storage and Transfer)

5.2.4 Filter Backwash System

Filters are provided throughout the plant to remove particulate matter and undissolved solids from process streams. The filters are flushable type which utilize a stack of chemically etched disks for filter elements. Filtered solids are removed with flush water from the PMS. Makeup water is also provided to flush the transfer pump to prevent buildup of solids. The primary makeup water valves used to flush the filters are controlled by the FBS. See Figure 7.2.

5.2.5 Boron Recycle System

Makeup water is provided to the recycle evaporator reagent tank, the recycle evaporator package, and the condensate demineralizers. The makeup water to the recycle evaporator packages serves as: (1) flushing water for lines, concentrator feed pumps, and feed tank; (2) flushing water for concentrator; and (3) flushing water for concentrator level controller. The makeup water to the condensate demineralizers serves as: (1) backwash to clean boron from the resin and (2) rinse water for removing spent reagent chemicals. Makeup water is used for mixing batches of caustic solution in the reagent tank for chemical addition to the BRS. (See SD-109)

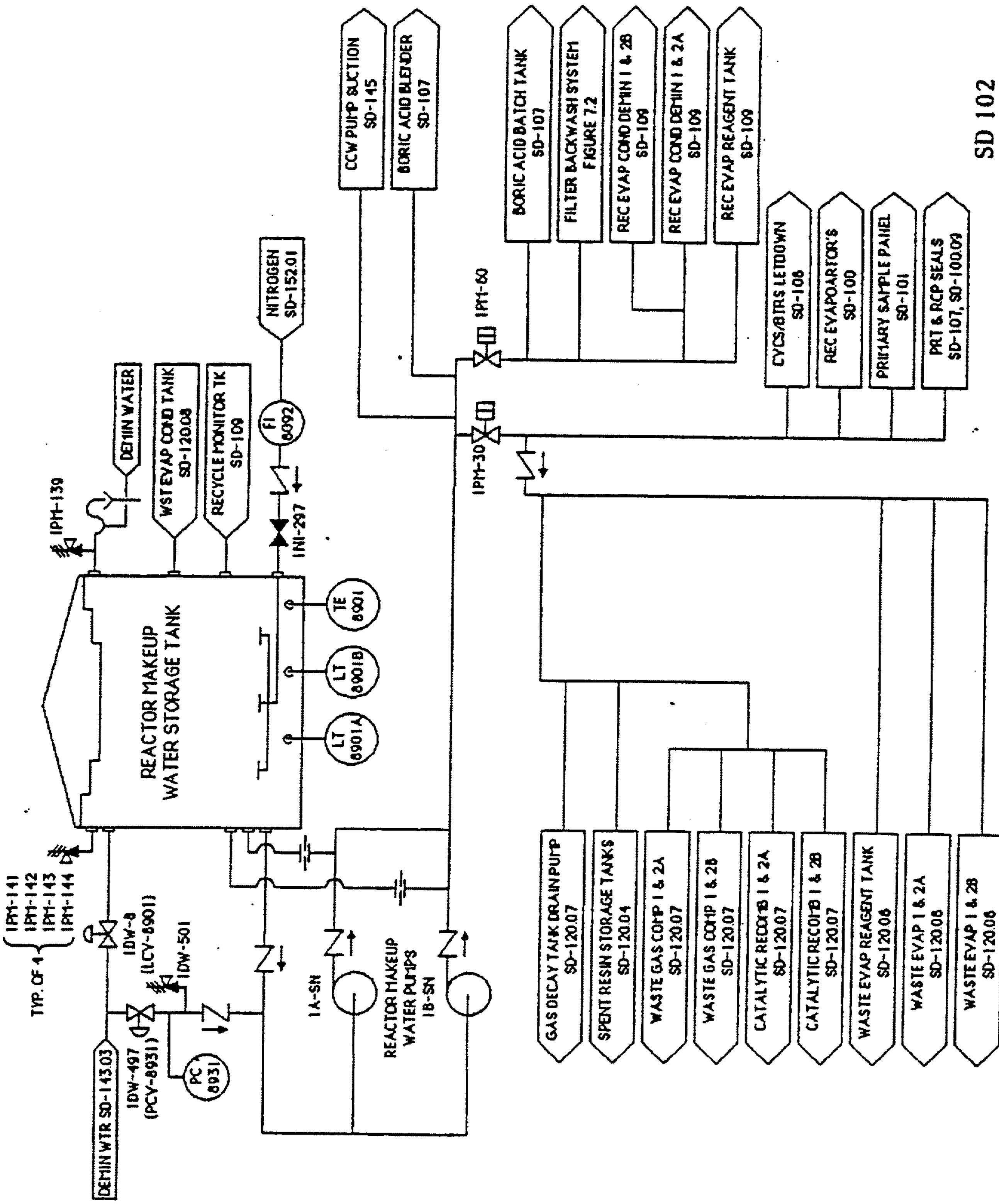
5.2.6 Chemical and Volume Control System

Makeup water is provided to the boric acid batch tank, boric acid blender, and the boron thermal regeneration demineralizers. The makeup water to the boric acid batch tank serves as the water supply for mixing batches of boric acid. The makeup water to the boric acid blender serves as the water supply for makeup or dilution of the Reactor Coolant System. Makeup water to the boron thermal regeneration demineralizers serves as backwash to clean boron from the resin. Primary makeup may also be introduced to the Boron Thermal Regeneration System (BTRS) upstream of the letdown reheat heat exchanger. The primary makeup water may be used to effect a more efficient removal of boron from the demineralizer resin. (See SD-107, CVCS.)

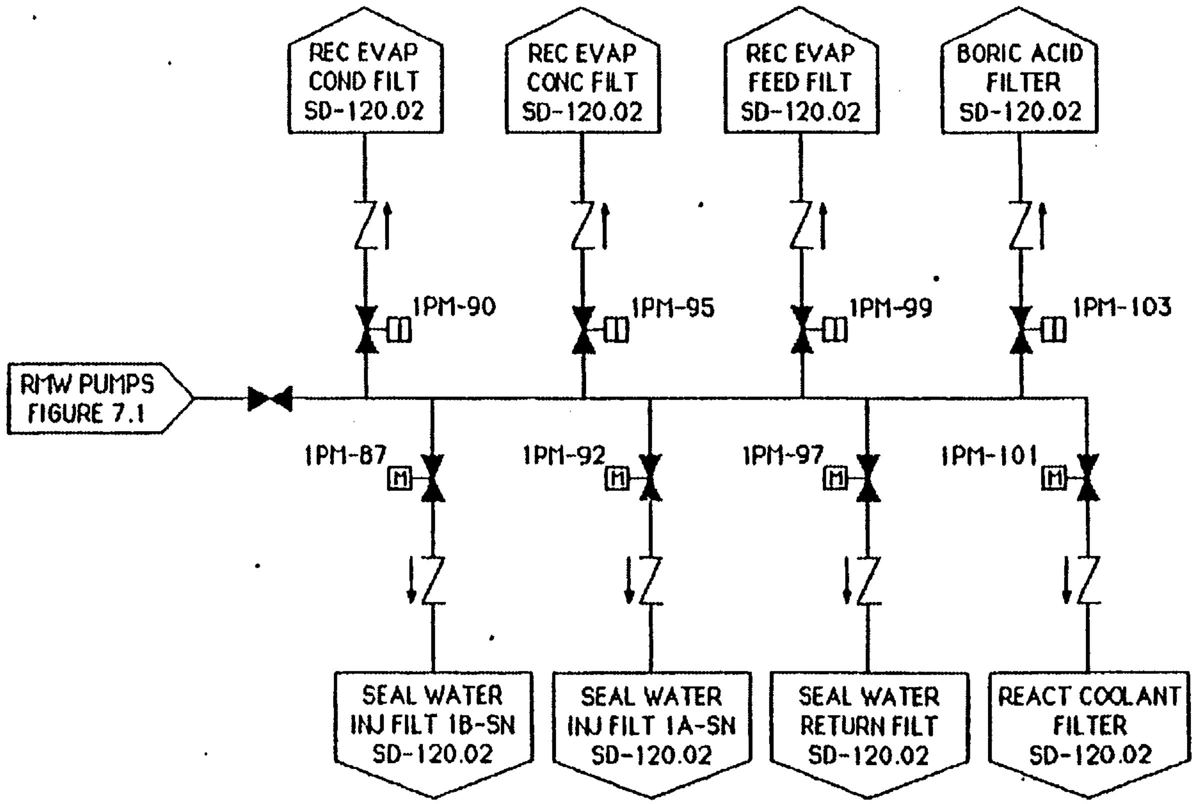
6.0 TABLES

None

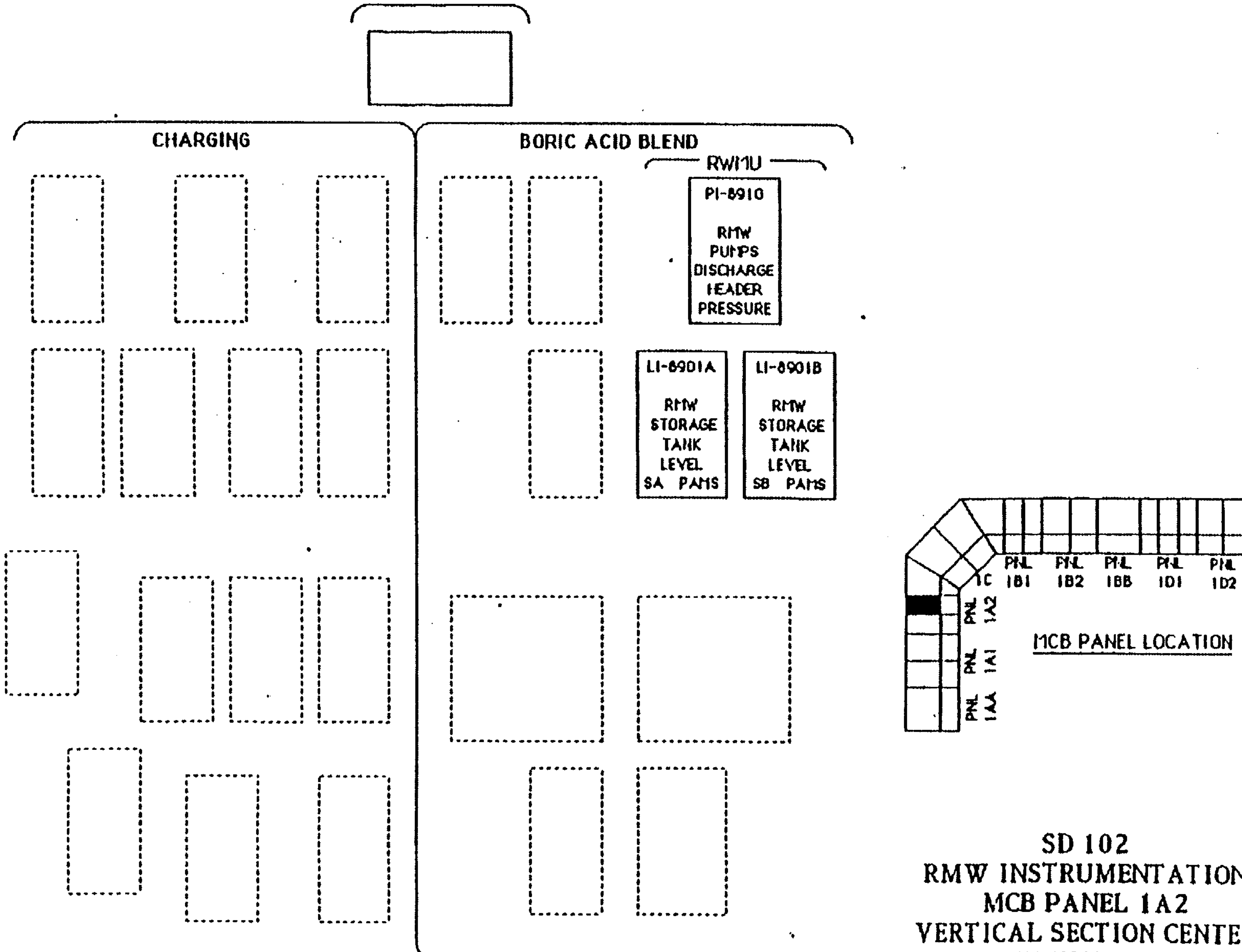
7.0 FIGURES



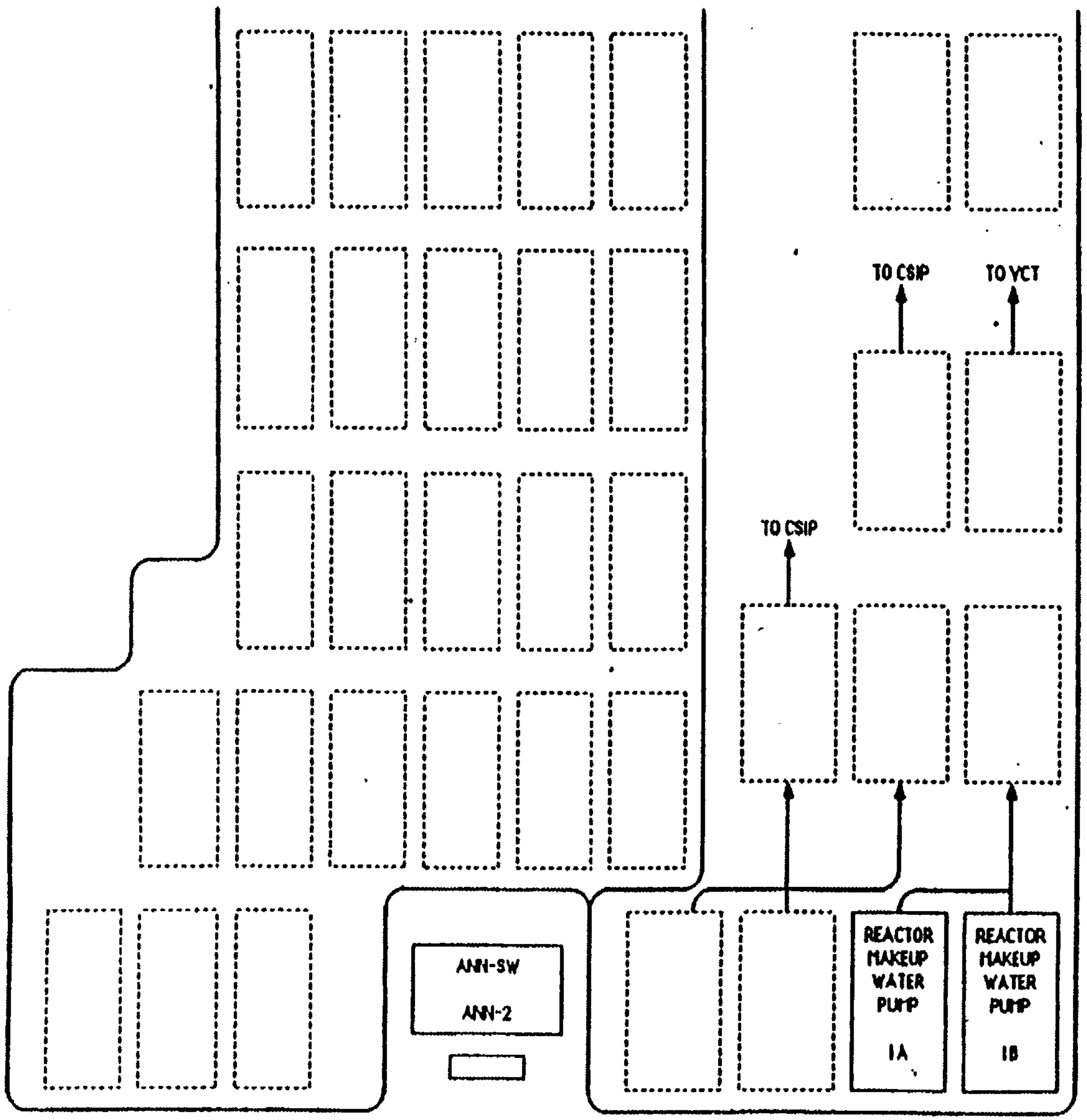
SD 102
PRIMARY MAKEUP SYSTEM
FIGURE 7.1

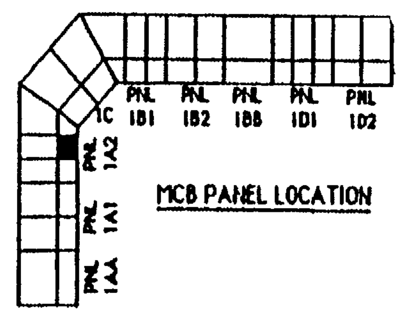


SD 102
PRIMARY MAKEUP TO
FILTER BACKWASH SYSTEM
FIGURE 7.2

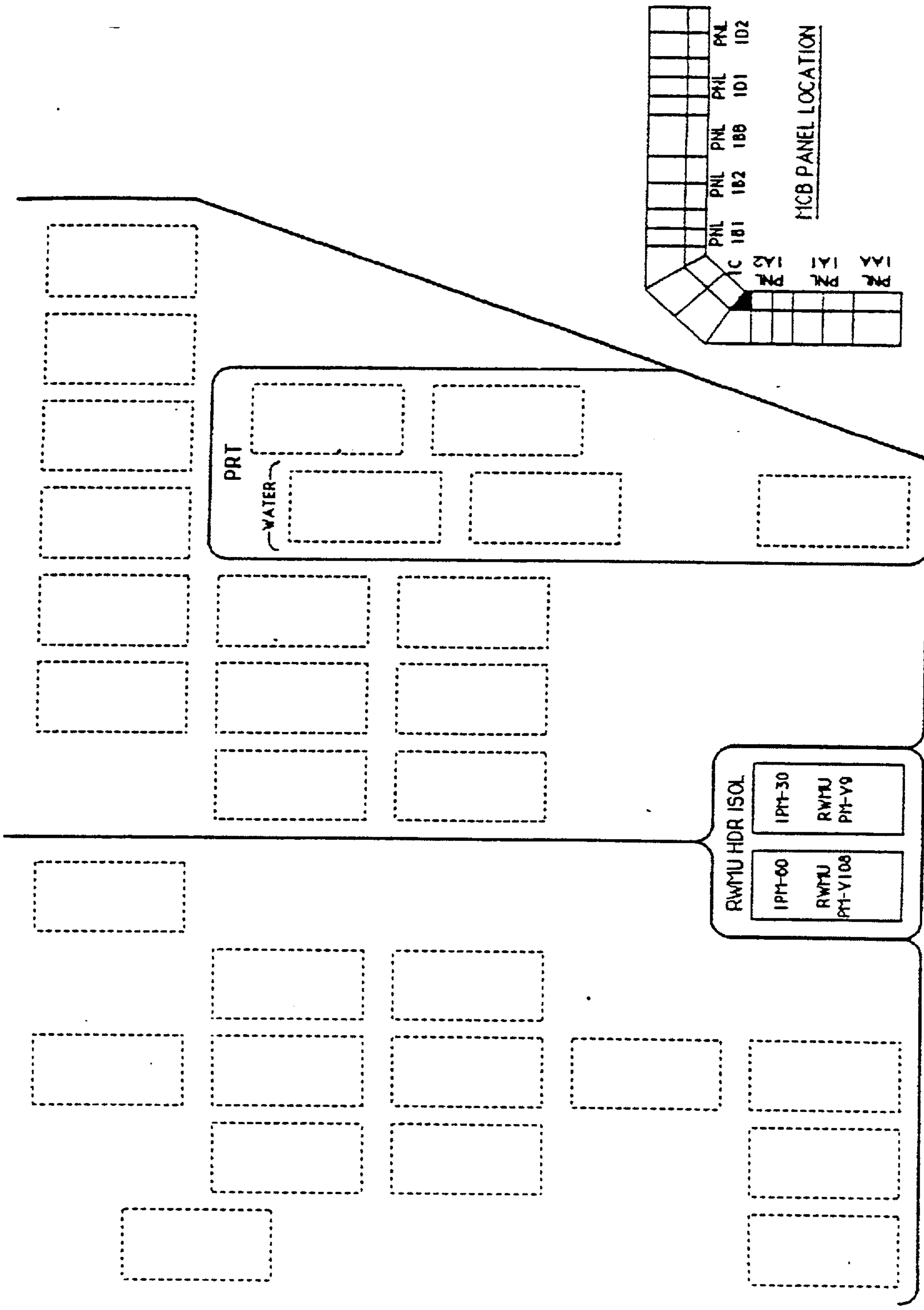


SD 102
RMW INSTRUMENTATION
MCB PANEL 1A2
VERTICAL SECTION CENTER
FIGURE 7.3





SD 102
RMW CONTROLS
MCB PANEL 1A2
DESK SECTION CENTER
FIGURE 7.4



SD 102
RMW CONTROLS
MCB PANEL 1A2
DESK SECTION RIGHT
FIGURE 7.5

8.0 REFERENCES

8.1 Drawings

8.1.1 Flow Diagrams

CAR-2165-G-52 Flow Diagram Sampling System - (Nuclear)

CAR-2165 G-299 Flow Diagram Primary and Demineralizer Water Systems - RAB

CAR-2165 G-829 Flow Diagram Filter Backwash System - RAB

CAR-2165 G-805 & 807 Flow Diagram Chemical and Volume Control System

CAR-2165 G-811 & 812 Flow Diagram Boron Recycle System

CAR-2165 G-814 Flow Diagram WPS Waste Hold-up and Evaporation

CAR-2165 G-818 Flow Diagram WPS Waste Gas Compressors and Recombiners

CAR-2165 G-817 Flow Diagram WPS Gas Decay Storage

CAR-2165 G-815 Flow Diagram WPS Spent Resin Storage

CAR-2165 G-801 Flow Diagram Reactor Coolant System

CAR-2165 G-829 Flow Diagram RAB Filter Backwash System

CAR-2165-G-819 Flow Diagram Component Cooling Water System

CPL-2165 S-0552 Simplified Flow Diagram Sampling System - (Nuclear)

CPL-2165 S-0779 Simplified Flow Diagram Primary & Demineralizer Water Systems - RAB

CPL-2165 S-1301 Simplified Flow Diagram Reactor Coolant System

CPL-2165 S-1305 Simplified Flow Diagram Chemical and Volume Control System

CPL-2165 S-1307 Simplified Flow Diagram Chemical and Volume Control System

CPL-2165 S-1311 Simplified Flow Diagram Boron Recycle System

CPL-2165 S-1312 Simplified Flow Diagram Boron Recycle System

8.1.1 Flow Diagrams (continued)

CPL-2165 S-1314 Simplified Flow Diagram Waste Processing System Waste Hold-up & Evaporation

CPL-2165 S-1315 Simplified Flow Diagram Waste Processing System Spent Resin Storage

CPL-2165 S-1317 Simplified Flow Diagram Waste Processing System Gas Decay Storage

CPL-2165 S-1318 Simplified Flow Diagram Waste Processing System Waste Gas Compressors and Recombiners

CPL-2165 S-1319 Simplified Flow Diagram Component Cooling Water System

CPL-2165 S-1329 Simplified Flow Diagram RAB Filter Backwash System

8.1.2 Control Wiring Diagrams

CAR-2166 B-401 Sheet 2381, Reactor Makeup Pump 1A-SN

CAR-2166 B-401 Sheet 2382, Reactor Makeup Pump 1B-SN

CAR-2166 B-401 Sheet 2383, Reactor Makeup Water Storage Tank Instrumentation

CAR-2166 B-401 Sheet 2384, Reactor Makeup Water Isolation Valve 3PM-V108-SN-1

CAR-2166 B-401 Sheet 2385, Reactor Makeup Water Isolation Valve 3PM-V9-SN-1

CAR-2166 B-401 Sheet 2388, Primary Makeup Water Demineralizer to RMWST 1X-SN Inlet Valve 7DW-L1-1

CAR-2166 B-401 Sheet 9131, Backflushable Filters, Boric Acid Filter 1x-SN Valves

CAR-2166 B-401 Sheet 9132, Backflushable Filters, Recycle Evap. Feed Filter 1 & 2A SN Valves

CAR-2166 B-401 Sheet 9133, Backflushable Filters, Recycle Evap. Concentrate Filters 1 & 2A Valves

CAR-2166 B-401 Sheet 9134, Backflushable Filters, Recycle Evap. Condensate Filter 1 & 2A Valves

CAR-2166 B-401 Sheet 9135, Backflushable Filters, Reactor Coolant Filter 1x-SN Valves

8.1.2 Control Wiring Diagrams (continued)

CAR-2166 B-401 Sheet 9136, Backflushable Filters, Seal Water Return Filter 1x-SN Valves

CAR-2166 B-401 Sheet 9139 Backflushable Filters, Seal Water Injection Filter 1A Valve 2PM-V172SN-1

CAR-2166 B-401 Sheet 9143 Backflushable Filters, Seal Water Injection Filter 1B Valve 2PM-V176SN-1

CAR-2166 B-401 Sheet 9231 Backflushable Filters, Local Control Panel Interconnections

CAR-2166 B-401 Sheet 9232 Backflushable Filters, Local Control Panel Interconnections

CAR-2166 B-401 Sheet 165 Pressurizer Relief Tank to Reactor Make-up Water Supply Isolation Valve 1-8028

CAR-2166 B-401 Sheet 240 Reactor Make-up Water to Boric Acid Blender Valve FCV-114B

8.1.3 Logic Diagrams

CAR-2166 B-430 Sheet 15.1, Reactor Makeup Water Storage Tank and Pumps

CAR-2166 B-430 Sheet 15.2, Reactor Makeup Water Storage Tank Level Control - Logic

CAR-2166 B-430 Sheet 15.3, Reactor Makeup Water Pumps - Logic

8.1.4 General Arrangements

8.2 Specifications

CAR-SH-AS10 Ebasco Specification for Field Erected Storage Tanks

8.3 Technical Manuals

BHP Chempump Pumps; Reactor Makeup Water

8.4 Other

Design Basis Document No. 102, Primary Makeup System

SHNPP Final Safety Analysis Report, Section 9.2.3.3

SHNPP Final Safety Analysis Report, Sections 11.2 & 11.3

Revision Summary

Pages 3 and 6: Incorporated ESR 96-00594, Rev. 0, "Drawing Change for 1DW-6."

Page 2: Changed Section 7 title from "Drawings" to "Figures."

Removed duplicate figure titles from Figures 7.1 through 7.5.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: CPL-2165 S-0799, REV. 10: SIMPLIFIED FLOW DIAGRAM PRIMARY & DEMINERALIZER WATER SYSTEMS REACTOR AUXILIARY BUILDING

UNIT 1

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CPL-2165 S-0799, REV. 10:

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CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description SD

NUMBER: SD-149

TITLE: Fire Protection/Detection Systems

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1.0 SYSTEM PURPOSE

1. The purpose of the fire protection program is:

   a. To insure the capability to shut down the reactor safely, maintain it in a safe shutdown condition, and limit the radioactive release to the environment in the event of a fire.

   b. To minimize both the probability and the consequences of fires; hence, protecting plant personnel and plant related equipment and property.

2.0 SYSTEM FUNCTION

The SHNPP fire protection program consists of design features, personnel, equipment, and procedures to provide defense-in-depth protection of public health and safety. The defense-in-depth program is implemented through plant system and facility design, fire prevention, fire detection, annunciation, confinement, suppression, administrative controls, fire brigade organization, inspection and maintenance, training, quality assurance, and testing.

For those plant systems necessary to achieve and maintain safe plant shutdown, both passive fire prevention and damage limitation design features as well as active fire protection equipment are provided. The systems are designed to operated with or without off site power. FP systems have appropriate capability and adequate capacity without off site power for all postulated fires.

Design concepts used in the fire protection program provide assurance that a fire will not cause the complete loss of function of safety-related systems, even though limited loss of redundancy within one system may occur.

Plant areas are protected, as required, based on the hazards present in the area. For hazardous areas, primary fire protection capability is provided by automatic fire detection and extinguishing systems in conjunction with separational fire barriers. However, the design of the fire protection system is based on a good detection system; hence, allowing manual extinguishing of a small fire first with automatic extinguishing being utilized for fast developing fires. Since total reliance is not placed on a single fire extinguishing system, appropriate backup fire extinguishing capability is provided throughout the plant to limit the extent of fire damage.

Hose stations, portable fire extinguishers, complete personnel protective equipment, and air breathing equipment are provided for use by properly trained personnel. Personnel access to areas is provided to permit effective manual use of fire extinguishing equipment on area fires.

2.1 Brief Description of Fire Protection/Detection Systems

The fire protection pumps take suction from the Auxiliary Reservoir and disperse water throughout the plant site. The distribution system makes a complete loop around the major buildings with cross connections through the buildings and with a secondary loop around some outlying building and branch lines for the outlying areas. Water pressure is maintained by the FP jockey pump with the larger pumps cutting in on demand. The water is provided to hose stations, fire hydrants, deluge valves, and sprinkler heads (wet systems) ready for use. Water release may be by manual and/or automatic means. Manual release of water may be done by use of hoses or by manual trip of the deluge valve. Automatic release of water may be triggered by the fire detection system via deluge valves and/or by heat on a sprinkler head.

The fire detection system uses ionization, thermal, and ultraviolet flame detectors to provide complete detection coverage. FD also provides its own supervisory system to warn of any malfunctions in the detection/protection systems or misalignment in the system.

2.2 Defense-In-Depth

Even with the high priority placed on fire prevention in plant design, fires can be expected to occur. Hence, adequate means for prompt detection, effective control, and suppression is provided through the defense-in-depth concept. The defense-in-depth concept provides this by achieving an adequate balance in:

1. Prevention of fires through the control of combustibles, separation of redundant trains, and guarding of sources of ignition. This is done by use of fire barriers, doors, dampers, and cable coatings.

2. Prompt detection of fires in areas containing safety-related equipment or in areas of high combustible loading which may expose safety-related equipment.

3. Effective suppression of fires to limit damage and to protect safety-related equipment. This is done by the use of sprinkler, hose, and foam spray system, as well as manual means.

4. Confinement of fires by provision of fire barriers, spatial separation, and segregation of combustibles.

5. Separation of redundant safety-related equipment to maintain operational capability under fire conditions.

2.3 Active/Passive Systems

The various parts to the fire protection program are divided into two (2) groups, active and passive systems; defined as follows:

1. Active system components are recognized as fire protection systems which include fire detection, suppression, and control systems and equipment.

2. Passive systems/components are structural components which limit the scope of a fire by providing isolation of heat, smoke, etc., or by protecting the building structure from the effects of a fire.

   a. Concrete cover on rebar

   b. Fire walls/barriers

   c. Fire doors/dampers

   d. Cable coatings

   e. Separation of redundant system

2.4 Distribution System

Fire protection system piping is separate from all other plant water systems. The fire protection water distribution system consists of an underground 12 in. mechanical joint, ductile iron, cement, or bituminous lined pipe loop around the main plant building complex to supply the water requirements for fire production systems and equipment. The underground loop is connected to provide flow from at least two directions.

The power block piping is 6 and 8 in. ductile iron, cement, or bituminous lined pipe for underground runs and carbon steel pipe, suitably supported, for above-ground piping within buildings.

Within the power block piping is a Safe Shutdown Earthquake (SSE) standpipe header which is isolated from the remainder of the system via seismic check valves. Normally this header is supplied from the fire protection system. Following an SSE event, water will be supplied from other Emergency Service Water System through manual valves. There are two connections from the discharge of ESW Booster Pumps 1A-SA and 1B-SB. The building which have SSE standpipe header are CB, RAB, and FHB.

All sectional and isolation valves in the Fire Suppression Water Supply System (except hydrant valves and inside hose connections) are either Post Indicator Valves (PIVs) for underground piping or Outside Screw and Yoke (OS&Y) valves for interior building piping.

2.4 Distribution System (continued)

Post Indicator Valves are provided in the distribution system as required for adequate sectionalization of loops and isolation of branch lines to facilitate system maintenance. Isolation valves are located in branch lines connecting to fire suppression systems in the buildings to avoid closing sectional valves in the main loop. Sectional isolation valves are provided in the yard loop piping to minimize the impairment of the fire protection water supply if maintenance on the loop or on yard hydrants becomes necessary.

The system is provided with relief pressure control valves to protect it from overpressurization.

Nonfreeze-type fire hydrants, equipped with one 4 in. and two 2-1/2 in. outlets, are installed approximately every 250 ft. along the fire main loop in the yard area around the main plant building complex and are protected by posts from vehicular traffic. Branch connections from the main loop supply hydrants, hose stations, and systems at outlying structures. Hose houses are equipped with the standard complement of 2-1/2 in. fire hose, nozzles, and hose-line equipment in accordance with National Fire Protection Association (NFPA) 24 requirements. A curb box valve is installed on all hydrant branches.

Screw threads and gaskets for fire hose and hose-line equipment are National Fire Hose Threads (NH), in accordance with NFPA No. 1963.

CAUTION

Set points given in this SD are for reference only. Actual values should be obtained from controlled set point documents.

3.0 COMPONENTS

3.1 Water Supply

Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir with storage capacity (317 acres and approximately 14 ft. deep) greatly exceeding the quantity required for fire protection.

3.2 Fire Pumps

There are three (3) types of fire pumps: (a) Jockey Pump 1-4X-NNS, (b) Motor Driven 1-4B-NNS, and © Diesel Driven 1-4A-NNS. The pumps are located as opposite ends of the Emergency SW Intake Channel Screening Structure with the Jockey and Motor side-by-side.

1. The Jockey pump maintains water pressure in the system at approximately 105 to 160 psig (set points for the Jockey are approximately 105 to 120, but the run timer allows the pressure to build up to the relief/pressure reg. valve settings). This pump is an AURORA Model 4RL 50 gpm pump at 290 ft. with a 7-1/2 hp electric motor drive. The Jockey pump power is supplied via 480 VAC MCC-1-4A 1012 compt. 1BR.

2. The Motor Driven Fire Pump is a Johnston Model 18CC-2, 100% capacity, outdoor type, vertical, 2500 gpm, 125 psi, and will deliver 3000 gpm at approximately 100 psig. Power for the motor driven fire pump via 480 V power center 1-4A101 comp 5A.

3. The Diesel Driven Fire Pump is a Johnston Model 18CC-2 100% capacity, outdoor type, vertical, 2500 gpm, 125 psi, and will deliver 3000 gpm at approximately 100 psig. Fuel is supplied for the diesel engine via 550 gallon tank of No. 2 oil located outdoors, adjacent to the pump area, suitably protected against fire. The location does not expose the fire pump to fire damage. A 12 in. dike is provided to contain the oil in case of an oil spill. The diesel driven fire pump starting power is supplied by two independent 24 VDC battery units. The power supplies for heaters, battery chargers, controls, and low fuel switch are 120 VAC PP-1-4A 10121 ckts. 14, 16, and 18.

3.3 Fire Extinguishers

Fire extinguishers are UL listed and/or FM approved and labeled accordingly. Extinguishers are mounted in readily accessible locations.

Extinguisher selection is based on the nature of the fire postulated.

The basic types of fires are Classes A, B, C, and D, as defined in the following subsections.

Class "A" fires are in ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics.

Class "B" fires are in flammable liquids, gases, and greases.

3.3 Fire Extinguishers (continued)

Class "C" fires involve energized electrical equipment where the electrical nonconductivity of the extinguishing media is of importance.

Class "D" fires are in combustible metals such as magnesium, titanium, zirconium, sodium, and potassium.

The following basic types of extinguishers are used:

Dry chemical: - hand - in operational areas or outdoor areas of severe fire potential (Class A, B, C).

Carbon dioxide or Halon: - in area of low fire hazards or containing small electrical equipment where cleanup after the fire is a major consideration such as control rooms, laboratories, and switchgear areas (Class B, C).

Water: - in areas containing ordinary combustible such as warehouses and offices (Class A).

4.0 OPERATIONS

4.1 Normal Operations

CAUTION

Set point given in this SD are for reference only. Actual valves should be obtained from a controlled set point document.

The fire protection system is a pressurized water system and is maintained at approximately 105-160 psig by the Jockey pump. The fire detection system is always in operation.

If a fire is detected by the detection system or by plant personnel, the following sequence of events occurs from detection to restoration of the systems:

1. A fire is detected by the detection system or plant personnel, and the alarm is sounded at the LFDCP. The LFDCP transmits the alarm signal to the MFDIC and, in turn, it is transmitted to the affected Main Control Room.

2. If personnel detect a fire, manual means will be utilized for suppression of the fire.

4.1 Normal Operations (continued)

3. If a fire is detected by the fire detection system, a signal will be transmitted from the LFDCP to open the deluge valve in the affected area. This allows water to flow up to the sprinkler head or through the open spray head. The sprinkler head will be activated by heat.

4. When the suppression system is activated, the flow demand will be greater than the capacity of the jockey pump. The motor-driven fire pump will start automatically when the pressure drops to 93 psig. If pressure continues to drop, because of pump failure or system demands, the diesel-driven fire pump will start at 83 psig.

5. After the fire is suppressed and flow in the system is stopped, the fire pumps are stopped manually.

6. The fire protection and detection systems are restored to normal by resetting alarms, replacing sprinkler heads, draining dry headers, etc.

4.2 General Fire Protection Operations

4.2.1 Pumps

The jockey pump starts automatically upon a drop in system pressure and stops after a time delay upon restoration of system pressure. This time delay prevents unnecessary cycling of the pump. The jockey pump has a controlling pressure switch on the discharge for each main fire pump to allow for individual pump repair.

The fire pumps are designed for sequential automatic starting on progressive drops in fire main water pressure. The jockey pump maintains system pressure at approximately 105-160 psig. The motor-driven fire pump then starts automatically when the pressure in the system drops to 93 psig. If the pressure continues to drop, the diesel-driven fire pump starts automatically at 83 psig. Both pumps are stopped manually at the local pump controller.

The pump discharges are piped and valved so that either pump can discharge to either loop connection, each pump may be isolated so that system integrity is not lost if one pump's integrity is lost.

A pump test discharge header is provided of such capacity that the three fire pumps may be given initial acceptance flow test and periodic performance tests. The discharge of flow test water is sent back to the reservoir. Water discharged from the pressure relief valves on the fire pumps and jockey pump are returned to the reservoir.

4.2.2 Fire Suppression Systems

Primary fire suppression systems for the plant discharge water through sprinkler heads, water spray nozzles, or, with the addition of foam solution, through foam making devices. Each system is designed, procured, installed, and tested with guidance from applicable NFPA standards.

Suppression systems discharging water automatically through open heads are water spray systems and provide one step water release. Also limited wet pipe systems are provided for one step water release through sprinkler heads. Suppression systems discharging water automatically into dry piping, closed by sprinkler heads, are either multi-cycle or preaction systems providing two step water release.

Two step water release requires not only actuation of the sprinkler flow control valve by automatic detectors or manual fire alarm stations but also fusing of the sprinkler head linkage by heat from the fire before water can discharge from the sprinkler head. This operational concept is employed to avoid unnecessary water damage resulting from premature discharge or inadvertent operation caused by system misoperation or mechanical damage. Most system piping is normally dry beyond the sprinkler control valve. Supervisory air pressure in closed piping systems is maintained by small system air compressors at the system riser. The compressors are part of the FP system.

Sprinkler system discharge densities are hydraulically designed to deliver 0.3gpm/sq. ft. for the most remote areas of 3000 sq. ft. or less.

1. Preaction Sprinkler Systems are automatic sprinkler systems supplied through hydraulically designed piping systems, containing air under a supervisory pressure of 20-25 psi downstream from the preaction valve. Each system is automatically actuated by a thermal fire detection system, which responds before fusing of the sprinkler fusible link. Actuation of the fire detection system opens the preaction valve, allowing water flow into the piping system and discharge from any sprinklers which were opened by heat from the fire. Lack of water flow through any preaction valve is alarmed, locally, in the Communications Room and in the Control Room.

   Each preaction sprinkler system is provided with separate preaction valves, automatic and manual actuation, local alarm, valve supervision, and annunciation in the Communications Room and the Control Room.

4.2.2 Fire Suppression Systems (continued)

For preaction sprinkler systems covering more than one hazard, independent detection-actuation systems, each with specific alarms.

2. Multi-Cycle Sprinkler Systems are preaction sprinkler systems modified to provide the capability for continued on-and-off cycling by shutting off the water supply automatically at the multi-cycle valve after detection system indicates that the fire has been extinguished. Water damage is thus minimized, and the hazard of unnecessary water is avoided. Each multi-cycle sprinkler piping system is hydraulically designed and is filled with air under a supervisory pressure of 20-25 psi downstream from the multi-cycle valve. In the event of damage to the detection circuit, the sprinkler system is capable of being switched to low pressure air system operation mode, maintaining the protection, alarms, and supervision of this sprinkler system.

When controlled by the fire detection system, the multi-cycle system is capable of automatically cycling "on" whenever any detector senses heat or "off" after all the detectors in the detection system sense that the temperature has decreased below their actuation point. Water will continue to flow from opened sprinkler heads for a predetermined period of time, after which the valve closes and the flow of water stops. If the temperature again rises to the rating of any thermal detector in the system that controls the multi-cycle system, the multi-cycle valve will reopen and immediately restart the flow of water to extinguish the reignited fire. Lack of water flow through any multi-cycle valve is alarmed.

Each multi-cycle sprinkler system is provided with separate multi-cycle valves, automatic and manual actuation, manual reset, local alarm, valve supervision, and with annunciation in the Communications Room and the Control Room.

For multi-cycle sprinkler systems covering more than one hazard, the following are provided for each hazard:

a. independent detection-actuation systems, and

b. specific alarms.

4.2.2 <u>Fire Suppression Systems</u> (continued)

3. Wet Pipe Sprinkler System - Unlike the other sprinkler systems, the wet pipe system has water up to the sprinkler heads; hence, any actuation of the sprinkler head will cause water flow until the header isolation valve is closed. The sprinkler heads are area, natural brass, and fusible link type. The wet pipe system is used mostly in the warehouses, Administrative Building, etc.

4. Water Spray Systems consist of open water spray heads supplied through hydraulically designed piping systems, with water flow controlled by a deluge valve. The deluge valve is actuated automatically by the operation of a fire detection system installed in the same area of coverage as the spray heads. When a detector senses fire, the deluge valve opens and the water flows into the piping system and discharges simultaneously from all spray heads in the system. Lack of water flow through a deluge valve is alarmed locally and in the Control Room via Communications Room.

   Separate water spray systems with automatic and manual actuation, local alarm and valve, and with annunciator in both the Communications Room and the Control Room.

5. A Foam System is provided for the Auxiliary Boiler Fuel Oil Storage Tanks, located in the yard. This system is a manual semifixed type using fluoroprotein mechanical foam. Each tank is equipped with one fixed, Type II discharge outlet and foam maker connected to a fixed piping installation, which terminates at a safe distance from the tank outside the dike, with a capped connection. The necessary foam-producing materials and equipment (foam concentrate line proportioner and hose) are stored in a nearby hose house. The water supply for the foam system will be taken from a nearby hydrant in the yard distribution system.

   After the foam solution is depleted, water will continue to flow unless shut off manually.

   An auxiliary foam protection system is provided for fire protection for spills in the dike area. This system consists of a line type proportioner, hose, and foam nozzle adapter stored in the hose house with other foam equipment.

4.2.2 Fire Protection Systems (continued)

6. Standpipe and Hose Systems are installed throughout the plant for use on identified hazards and involved equipment. Sufficient hose stations are provided in each area so that all portions of the plant can be reached by effective hose streams for at least two (2) hose stations.

   Individual standpipes are a minimum 4 in. diameter for multiple hose connections and 2-1/2 in. diameter for single hose connections. Hose stations are equipped with 100 ft. of 1-1/2 in. fire hose and adjustable spray nozzles. The spray nozzles are approved for use on energized electrical equipment and cabling.

   Operation of a hose station associated with a particular riser is alarmed locally and alarmed and annunciated in the Communications Room and the Control Room following sensing of water flow in the standpipe riser by system flow switches.

   Sectional shut-off valves provided for standpipes serving hose stations in safety-related areas are located outside the safety-related areas to permit access during a fire. Seismic piping is provided for areas of the Containment, Reactor Auxiliary, and Fuel Handling Buildings which are required for safe plant shutdown following a Safe Shutdown Earthquake (SSE). This is done both to maintain fire protection and to protect safety-related equipment from possible damage due to fire protection system failures.

7. Halon 1301 System protects the QA Records Storage Rooms and the PABX Rooms in the Administration Building and the Technical Support Center PABX Room. The banks of Halon 1301 cylinders are sized to produce a 10% concentration in these areas within 30 seconds.

   The system utilizes ionization detectors which activates an alarm, de-energizes air-handling units, and closes air dampers in the area protected by Halon 1301. However, ionization detectors do not trip the Halon system. Thermal detectors are utilized to activate the Halon system.

4.3 General Operations

1. The Fire Detection System is designed to detect fires; activate the fire protection equipment; monitor the operating status of fire protection system components; annunciate fire, operation, trouble, and actuation signals; activate fire alarms; and identify the location of the fire.

   The Fire Detection System provides devices, equipment, and wiring required to perform the following functions:

   a. Detect the presence of products of combustion through use of ionization type detectors provided on an area basis.

   b. Detect the presence of heat from a fire through use of thermal rate compensation, combination rate anticipation/fixed temperature, and fixed temperature only type detectors provided on an area basis.

   c. Detect the presence of flame through use of ultraviolet type detectors provided on an area basis.

   d. Detect the drop in supervising air pressure following loss of integrity of fire protection sprinkler system piping.

   e. Detect the flow of water in fire protection piping.

   f. Indicate the operation of supervised fire protection control equipment.

   g. Activate sprinkler and water spray system control valves and other accessory equipment required for fire control.

   h. Indicate activation, detection, alarm, or trouble signals at local panels and at the main fire detection information center with associated annunciation provided in the main control room.

   I. Indicate location of signal origination or identification of monitored equipment.

   j. Provide internal supervision of all portions of the detection system, indicate trouble conditions, and provide fault diagnostic indications.

   k. Activate localized alarm systems, employing bells, horns, or lights to alert plant personnel of a fire alarm or a system trouble signal generation.

   1. Shut down ventilation systems upon detection of products of combustion as required.

4.3 General Operations (continued)

2. The Fire Detection System satisfies the following general design requirements:

   a. Fire detection devices and associated equipment are either UL listed and/or FM approved and so labeled. They are installed in accordance with manufacturer's instruction manual and NFPA Std. 72E.

   b. The Fire Detection System consists of data signaling loops used to carry fire and trouble alarms from the Local Fire Detection Control Panels (LFDCP) to the Main Fire Detection Information Center (MFDIC). The alarm signals are transmitted by a solid state digital multiplexing technique. The signal transmission system is completely supervised by automatic built-in test equipment and alarmed on the MFDIC when a trouble condition exists. In general, the fire detection system utilizes a nominal 24 VDC for detection and processing alarm conditions.

      The MFDIC, located in the Communications Room on El. 317 in the RAB, supervises the Fire Detection System of the plant including directly associated support buildings. The fire and trouble alarm status for each fire zone is displayed on the Central Processor CRT display and printer located in the MFDIC-Central Control Unit (CCU). A data link is provided between the CCU Central Processor and the local MFDIC-Display Console PC which performs additional display, alarm processing, historical data storage and retrieval functions for the system. A data link is also provided between the CCU Central Processor and the ERFIS Computer for monitoring all fire alarm conditions. In addition to the CCU digital multiplexing system, a MFDIC Hard-Wired Annunciator Panel is also provided as a back-up system to display fire and trouble alarm status from each LFDCP to the MFDIC. Included on the Hard-Wired Annunciator Panel are indicating lights for the operational status of the fire pumps. The MFDIC I/O Report (2166-B-420) provides a cross reference of data between an individual LFDCP, the MFDIC and the ERFIS Computer for each fire zone.

      The Control Room Operator will be alerted to a fire or trouble condition via annunciation initiated from the Main Fire Detection Information Center (MFDIC). Upon obtaining specific alarm status information, either by dispatching an operator to the MFDIC for both fire and trouble conditions or by utilizing an ERFIS computer terminal for fire conditions, the Control Room Operator will be able to sound the alarm as needed for control of the situation, and provide instructin to site personnel through the use of plant communications system, as appropriate.

      Power for the Main Fire Detection Information Center (MFDIC) equipment, the Local Fire Detection Control Panels (LFDCPs) and associated fire suppression equipment is supplied from the balance of plant 60 KVA Static Uninterruptible Power Supply and the Security System 75 KVA Static Uninterruptible Power Supply. Table 6.1 is a listing of power feeds for the fire detection system.

4.3 General Operations (continued)

c. Each local fire detection control panel displays local alarm, trouble, normal, and activation signals. When a fire condition is sensed by a detector a white zone light is energized on the detector's respective LFDCP. Whenever there is a fire condition indicated at a LFDCP, an audible alarm (fire bell), which produces a sound distinctive from other alarm systems, is activated locally at the fire zone and at its associated LFDCP. A light is activated on the LFDCP, and if there is any required automatic action to be initiated for fire suppression, the LFDCP performs this function. In addition, the fire condition is indicated on the MFDIC located in the Communications Room. Any audible alarm can be silenced by means of a push button. Further, any local audible alarm may be silenced without affecting the remote alarm on the MFDIC. Fire detection panels are also equipped with "lamp test" push buttons. A local graphic display unit is provided for the cable spreading rooms located in the Reactor Auxiliary and Waste Processing Building. Graphic provided to show the hidden (sub-floor) detectors in the Reactor Auxiliary and Security Building Computer Rooms. These units give the layout of the fire zone and the arrangement and location of fire detection therein.

d. The supervisory system is designed to activate an audible alarm distinct from the fire alarm (fire horn) and an amber light at the LFDCP, as well, as indicted on the MFDIC on the occurrence of any of the following:

(1) Loss of electrical integrity in any detection circuit.

(2) Loss of electrical integrity in any activation circuit.

(3) Loss of electrical integrity in any alarm circuit.

(4) Failure of water to flow within five seconds after any deluge valve release is activated.

(5) Operation of any isolation or sectionalizing valve in the Fire Protection System away from their normal active position.

(6) Loss of supervisory air pressure in preaction and multi-cycle sprinkler systems.

4.3 General Operations (continued)

e. Operation of water flow detection devices.

f. A common trouble alarm is provided in the Main Control Room for the Main Fire Pumps.

g. All detectors are readily removable to facilitate periodic testing and maintenance. Detectors are designed in a way that in-place testing can be accomplished by means of a portable testing kit or apparatus.

4.3.1 Types of Detectors and Alarms

Fire detection systems (heat, smoke, or flame) are provided in safety-related areas or in areas that present potential fire exposure to safety-related systems or equipment, unless noted, as a deviation in the Safe Shutdown Analysis in Case of Fire. Annunciators and alarms are transmitted to the MFDIC, located in the Communications Room, which in turn, alerts the Control Room.

Selection of detectors was done on the basis of suitability for the postulated fire. Where cables are present and smoldering, insulation was postulated, ionization type smoke detectors, sensitive to products of combustion, are provided. Where charcoal or combustible liquids are present and high heat release was postulated, rate compensated, combination rate anticipation/fixed temperature, and fixed temperature only type heat detectors are provided. In areas where flames could be present, ultraviolet fire detectors are provided.

1. Ionization Detection Systems are provided in areas where it is advisable to detect smoke and products of combustion at an early stage of a fire. Ionization detectors are provided on an area basis which is less than the maximums given in NFPA Standard 72E. Not less than two detectors are provided in any single area. Detectors are equipped with an integral signal lamp to indicate alarm condition. Except for loss of sensitivity, detectors are not adversely affected by short-term high radioactivity exposures. Detectors in the Containment Building are capable of operation in a high level radiation environment.

2. Thermal Detection Systems are generally provided in the same areas where automatic sprinkler systems are installed and are used for activation of sprinklers. Thermal detectors are provided on an area spacing basis, which is less than the maximum specified in NFPA Standard 72E, and are of a rate compensated, rate anticipated/fixed temperature type, or fixed temperature only type. Each thermal detector has a minimum temperature setting of 30EF above environmental conditions for the location in which they are used. Sensitivity of detectors is not field adjustable.

4.3.1 Types of Detectors and Alarms (continued)

Rate compensated and rate anticipated/fixed temperature type thermal detectors interfaced with a fire extinguishing system (preaction or multi-cycle, except for the transformer yard) automatically reset themselves after an alarm-condition dissipates. This action resets the multi-cycle system automatically after a preset time delay. The preaction sprinkler system is manually reset at the valve. Any electrical circuit associated with the preaction sprinkler system is reset manually from the LFDCP. Loss of supervisory current activates sprinkler control valves allowing water flow into the sprinkler distribution piping. Activation of a fixed temperature only type heat detector utilized at the Main, Auxiliary, or Start-Up transformers will energize a deluge valve release solenoid which allows deluge of the transformer via an open head water spray system. The sprinkler must be manually isolated from the LFDCP or via the deluge manual isolation valve. The loss of power for Water Spray Systems (transformers and TB areas) does not activate these systems. They must be manually activated upon loss of power.

Only the fixed temperature type detectors require replacement after a fire alarm to restore them to normal operation. Detectors are not adversely affected by short-term high radioactivity exposures.

Thermal detectors used outdoors (transformer bays) or near equipment in large ceiling areas (reactor coolant pumps) have a heat collecting canopy.

3. Ultraviolet Flame Detection systems are provided in areas where oil is present, for example, Diesel Generator Building and fuel oil pump area.

   Flame detectors operate on a principle using a Geiger-Mueller gas-type cathode tube designed to detect flame-radiated rays in the extreme low end of the radiation spectrum. They are of split-architecture construction having NEMA 7, explosion-proof housing. They use a quartz lens, have a built-in checking system for optical integrity, and have the capability to reject high intensity ultraviolet radiation emitted from sources such as lightning by using an internal time-delay circuit. Each has a swivel mounting assembly suitable for vertical or horizontal mounting.

   Each flame detector controller is capable of operating up to eight flame detectors and is mounted in the associated LFDCP for the fire detection zone.

4. Manual Fire Alarm Stations are provided throughout plant operating areas, located to be readily accessible for employee use in signaling the existence of an observed fire condition. To the extent feasible, manual fire alarm stations are grouped with fire extinguishers and hose stations. In addition to initiating a fire alert, manual fire alarm stations are used to activate water flow to associated sprinklers or water sprays.

4.3.1 Types of Detectors and Alarms (continued)

Single action manual fire alarm stations are used in conjunction with fire zones with ionization, air duct, or ultraviolet detectors for early warning alarm. All single action stations are non-code signaling system, nonbreak-glass type, with a key operated test-reset lock in order that they may be tested. The station is designed so that after actual emergency operation, it cannot be restored to normal except by use of a key. An operated station automatically conditions itself so as to alarm visually, when operated, detectable at a minimum distance of 100 ft., front or side, depending on location. This is accomplished by a pull lever. Stations are electrically supervised from the LFDCP. stations are UL listed or FM approved and in compliance with NFPA-72A.

Double action manual fire alarm stations are used in conjunction with thermal detectors that actuate various automatic fire extinguishing systems. They have features similar to single action stations. However, in order to activate the circuit two distinct operations must be performed. This is accomplished by pushing a tab and pulling a lever.

5. Air Duct Detectors are provided within HVAC duct systems to indicate presence of smoke.

   These detectors are part of the Smoke Control System and provide automatic trip of ventilating systems, as required, in compliance with the NFPA 90A recommended practices. Indication for air duct detectors is connected to LFDCP and transmitted to the MFDIC.

4.4 Limitations by FPP-013

Plant Operating Manual, Volume 3, Part 8, FPP-013 limitations for operation in regard to Fire Protection/Detection are generally as follows (for the specific requirements and details, see FPP-013):

4.4.1 Fire Protection Water Supply and Distribution System

The Fire Protection Water Supply and Distribution System shall be OPERABLE at all times with:

1. At least (two) fire pumps, each with a capacity of (2500) gpm, with their discharges aligned to the fire suppression header.

2. The auxiliary reservoir water level shall be maintained at a level greater than 246 feet (USGS datum).

4.4.1 Fire Protection Water Supply and Distribution System (continued)

3. An OPERABLE flow path capable of taking suction from the auxiliary reservoir and transferring the water through distribution piping with OPERABLE sectionalizing control or isolation valves to the yard hydrant curb valves, the last valve ahead of the water flow alarm device on each sprinkler or hose standpipe, and the last valve on each spray system required to be OPERABLE.

4.4.2 Preaction and Multi-cycle Sprinkler System

The Preaction and Multi-cycle Sprinkler System listed in FPP-013 shall be OPERABLE whenever equipment protected by the Preaction and Multi-cycle Sprinkler System is required to be OPERABLE.

4.4.3 Fire Hose Stations

The fire hose stations given in FPP-013 shall be OPERABLE whenever equipment in the areas protected by the fire stations is required to be OPERABLE.

NOTE: Fire hose stations within the containment are required to be operable only during refueling and maintenance outages.

4.4.4 Yard Fire Hydrants and Hydrant Hose Houses

The yard fire hydrants and associated hydrant hose houses given in FPP-013 shall be OPERABLE whenever equipment in the areas protected by the yard fire hydrants is required to be OPERABLE.

4.4.5 Fire Rated Assemblies

All fire rated assemblies (walls, floor/ceilings, cable tray enclosures, and other fire barriers) separating safety-related fire areas or separating portions of redundant systems important to safe shutdown within a fire area and all sealing devices in fire-related assemblies penetrations (fire doors, fire windows, fire dampers, cable, piping, and ventilation duct penetration seals) shall be OPERABLE whenever the equipment in the area is required to be OPERABLE.

4.4.6 Fire Detection Instrumentation

As a minimum, the fire detection instrumentation for each detection zone shown in FPP-013 shall be OPERABLE whenever equipment protected by the fire detection instrument is required to be OPERABLE.

4.5 LFDCP Description

1. LFDCP-1 is located on the 236 RAB elevation at column line H/16. Although LFDCP-1 is located outside containment, all of its associated detectors are inside containment. Detection devices consist of 192EF thermal detectors, ionization type smoke detectors and handpull stations.

   The following zones make up LFDCP-1 detection:

Zone	Type Detection
1-1	Thermal
1-2	Thermal
1-3	Thermal
1-4	Thermal, Multi-cycle Deluge
1-5	Thermal, Multi-cycle Deluge
1-5a	Thermal, Multi-cycle Deluge
1-5b	Thermal, Multi-cycle Deluge
1-6	Thermal, Ionization, Multi-cycle Deluge
1-7	Thermal, Ionization, Multi-cycle Deluge
1-7a	Ionization, Handpull Station (Single Action)
1-120	Handpull Station (Dual Action)

   Deluge action from 1-6 & 1-7 thermal loops only.

   2166-B-401 Sh. 9526-9531
   1364-34209 1364-32893

2. LFDCP-2 is located on the 216 RAB elevation at column line GY/39. Although LFDCP-2 is located on 216 elevation RAB, the detectors are located at 190 RAB elevation. Detection devices consist of 135EF thermal detectors, Ionization type smoke detectors and handpull stations.

   The following zones make up LFDCP-2 detection:

Zone	Type Detection
1-8	Thermal, Handpull Station (Dual Action) Multi-cycle

4.5 LFDCP Description (continued)

Zone	Type Detection
1-9	Thermal, Handpull Station (Dual Action) Multi-cycle
1-10	Ionization
1-11	Ionization

2166-B-401 Sh. 9533-9535
1364-34211 1364-34173

3. LFDCP-3 is located on the 216 RAB elevation at column line G/39. Fire detectors are also located on 216 RAB elevation. Detection devices consist of 135EF thermal detectors, Ionization type smoke detectors and handpull stations.

   The following zones make up LFDCP-3 detection:

Zone	Type Detection
1-12	Handpull Station (Single Action)
1-13	Handpull Station (Single Action)
1-14	Ionization, Thermal, Handpull Station (Dual Action) Multi-cycle
1-15	Ionization
1-16	Handpull Station (Single Action)

   Deluge action from 1-14 thermal loop only.

   2166-B-401 Sh. 9538-9540
   1364-34214 1364-34173

4. LFDCP-4 is located on the 236 RAB elevation at column line GZ/39. Fire detectors are also located on 236 RAB elevation. Detection devices consist of 135EF thermal detectors, Ionization type smoke detectors and handpull stations.

   The following zones make up LFDCP-4 detection:

Zone	Type Detection
1-17	Thermal, Ionization and Handpull Station (Dual Action)

4.5 LFDCP Description (continued)

Zone	Type Detection
1-18	Thermal and Handpull Station (Dual Action)
1-19	Thermal and Handpull Station (Dual Action)
1-20	Thermal, Ionization and Handpull Station (Dual Action Station)
1-21	Thermal, Ionization and Handpull Station (Dual Action Station)
1-22	Thermal, Ionization and Handpull Station (Dual Action Station)
1-183	Thermal and Handpull Station (Dual Action Station)

Deluge action from thermal loop only of zone 1-17, 1-18, 1-19, 1-20, 1-21, 1-22 multi-cycle deluge system. Deluge action from thermal loop only for zone 1-183 preaction deluge system.

2166-B-401 Sh. 9542-9549
1364-34215 1364-32891

5. LFDCP-5 is located on the 261 RAB elevation at column line GZ/39. Fire detectors are also located on 261 RAB elevation. Detection devices consist of 135EF thermal detectors, ionization type smoke detectors and handpull stations.

The following zones make up LFDCP-5 detection:

Zone	Type Detection
1-23	Ionization, Handpull Station (Single Action)
1-24	Thermal, Ionization, Handpull Station (Dual Action)
1-25	Thermal, Ionization, Handpull Station (Dual Action)
1-26	Thermal, Ionization, Handpull Station (Dual Action)
1-27	Thermal, Ionization, Handpull Station (Dual Action)

4.5 LFDCP Description (continued)

Zone	Type Detection
1-28	Thermal, Ionization, Handpull Station (Dual Action)
1-29	Thermal, Ionization, Handpull Station (Dual Action)
1-30	Thermal, Ionization, Handpull Station (Dual Action)
1-31	Thermal, Ionization, Handpull Station (Dual Action)
1-57	Handpull Station (Single Action)
1-180	Fire Door Monitor Pnl. 2 (ABANDONED IN PLACE)

Deluge action from thermal loop only of zones 1-24, 1-25, 1-26, 1-27, 1-28, 1-29, 1-30, 1-31, multi-cycle deluge system.

2166-B-401 Sh. 9550-9554
1364-34218 1364-32889

6. LFDCP-6 is located on 286 RAB elevation at column line D-E/32. Fire detectors are also located on 286 RAB elevation. Detection devices consist of 135EF thermal detectors, ionization type smoke detectors and handpull stations.

The following zones make up LFDCP-6 detection:

Zone	Type Detection
1-32	Handpull Station (Single Action)
1-33	Ionization, Handpull Station (Single Action)
1-34	Ionization, Handpull Station (Single Action)
1-34	Ionization, Handpull Station (Single Action)
1-35	Ionization, Handpull Station (Single Action)
1-36	Ionization, Handpull Station (Single Action)

4.5 LFDCP Description (continued)

Zone	Type Detection
1-37	Ionization
1-38	Ionization
1-39	Ionization
1-40	Handpull Station (Single Action)
1-41	Thermal, Ionization, Handpull Station (Dual Action) LGP-1 B-401 9561
1-42	Thermal, Ionization, Handpull Station (Dual Station) LGP-2 B-401 9562
1-43	Ionization, Handpull Station (Single Action)
1-44	Ionization, Handpull Station (Single Action)
1-45	Thermal, Ionization, Handpull Station (Dual Action)
1-181	Fire Door Monitor Pnl #1 (ABANDONED IN PLACE)
1-41A	Ionization B-401 Sh. 9635
1-42A	Ionization
1-185	Ionization, Handpull Station (Single Action)

Deluge action from thermal loop only zones 1-41, 1-42, 1-45, preaction deluge.

2166-B-401 Sh. 9557-9560
1364-34221 1364-32890

7. LFDCP-7 is located on 305 RAB elevation at column line C-D/39. Fire detectors are also located on 305 RAB elevation. Detection devices consist of 135EF thermal detectors, Ionization type smoke detectors and handpull stations.

The following zones make up LFDCP-7 detection:

Zone	Type Detection
1-46	Ionization, Handpull Station (Single Action)

4.5 LFDCP Description (continued)

Zone	Type Detection
1-47	Ionization
1-48	Ionization
1-49	Ionization
1-50	Ionization LGP-3 B-401 Sh. 9556
1-51	Ionization
1-52	Ionization
1-53	Thermal, Ionization, Handpull Stations (Dual Action) B-401 Sh. 9565
1-54	Thermal, Ionization, Handpull Stations (Dual Action) B-401 Sh. 9638
1-55	Ionization, Handpull Station (Single Action)
1-56	Ionization
1-121	Ionization
1-129	Ops Office 142 Fire Detection Pnl
1-150	Duct Detector Ionization
1-151	Duct Detector Ionization
1-151A	Duct Detector Ionization
1-152	Duct Detector Ionization
1-153	Duct Detector Ionization
1-154	Duct Detector Ionization
1-155	Duct Detector Ionization
1-156	Duct Detector Ionization
1-157	Duct Detector Ionization
1-122	Ionization (Main Control Board)
1-123	Ionization, Handpull Stations (Single Action) B-401 Sh. 9555
1-188	Ionization, Handpull Stations (Single Action) B-401 Sh. 9555
1-189	Duct Detector Ionization

4.5 LFDCP Description (continued)

Deluge action from thermal loop only of zones 1-53 and 1-54 preaction deluge system.

2166-B-401 Sh. 9563-9568
1364-34223   1364-32887

8. LFDCP-8 is located on 240 Turbine Bldg elevation at column line Ay/27. Fire detectors are also located on 240 elevation. Detection devices consist of 135EF thermal detectors, Ionization type smoke detectors, and handpull stations.

The following zones make up LFDCP-8 detection:

Zone	Type Detection
1-58	Thermal, Ionization, Handpull Stations (Dual Action)
1-59	Thermal, Handpull Station (Dual Action)
1-61	Ionization
1-137	Turbine Storage Bldg Fire Detection Pnl

Deluge action from thermal loop only of zones 1-58 and 1-59 preaction deluge system through LFDCP-10.

2166-B-401 Sh. 9569-9571
1364-34724   1364-31120

9. LFDCP-9 is located on 261 Turbine Generator Bldg elevation at column line Aa/11. Fire detectors are also located on 261 elevation. Detection devices consist of 135EF and 194EF thermal detectors, Ionization type smoke detectors, and handpull stations.

The following zones make up LFDCP-9 detection:

Zone	Type Detection
1-62	Thermal 135EF, Handpull Station (Dual Action)
1-63	Thermal 135EF, Handpull Station (Dual Action)
1-64	Thermal 135EF, Handpull Station (Dual Action)
1-65	Thermal 135EF, Handpull Station (Dual Action)

4.5 LFDCP Description (continued)

Zone	Type Detection
1-66	Thermal 194EF, Handpull Station (Dual Action)
1-67	Ionization, Handpull Station (Single Action)

Deluge action from thermal loop only of zones 1-62, 1-63, 1-64, 1-65, 1-66 preaction deluge system. Deluge valves open when control solenoid is energized. Fire protection piping is open heads.

2166-B-401 Sh. 9573-9586
1364-34707 1364-31116

10. LFDCP-10 is located on 286 Turbine Generator Bldg elevation at column line Ap/11. Fire detectors are also located on 286 elevation. Detection devices consist of thermal detectors, Ionization type smoke detectors, and handpull stations.

The following zones make up LFDCP-10 detection:

Zone	Type Detection
1-68	Handpull Stations (Single Action)
1-69-1	Thermal, Handpull Station (Dual Action)
1-69-2	Thermal, Handpull Station (Dual Action)
1-70	Ionization
1-71	Thermal, Handpull Station (Dual Action)
1-72	Thermal, Handpull Station (Dual Action)
1-158	Duct Detector Ionization
1-159	Duct Detector Ionization
1-160	Duct Detector Ionization
1-161	Duct Detector Ionization
1-58	Deluge Signal From LFDCP-8
1-59	Deluge Signal From LFDCP-8

4.5 LFDCP Description (continued)

Deluge action from thermal loop only of zones 1-69-1, 1-69-2, 1-71, 1-72 preaction deluge system.

2166-B-401 Sh. 9588-9591
1364-34704 1364-31118

11. LFDCP-11 is located on 261 Turbine Generator Bldg elevation at column line Aa/19. Fire detectors are also located in the transformer yard. Detection devices consist of 190EF fixed temperature thermal detectors and handpull stations.

The following zones make up LFDCP-11 detection:

Zone	Type Detection
1-79	Thermal, Handpull Station (Dual Action) Main xfmr "C"
1-80	Thermal, Handpull Station (Dual Action) Main xfmr "B"
1-81	Thermal, Handpull Station (Dual Action) Main xfmr "A"
1-82	Thermal, Handpull Station (Dual Action) Start-up, xfmr "1A"
1-83	Thermal, Handpull Station (Dual Action) Start-up, xfmr "1B"
1-84	Thermal, Handpull Station (Dual Action) Unit Aux. xfmr "1A"
1-85	Thermal, Handpull Station (Dual Action) Unit Aux. xfmr "1B"

Deluge action from thermal loop only all zone. Deluge valves open when control solenoid is energized. Fire protection piping is open heads.

2166-B-401 Sh. 9593-9598
1364-33576 1364-32768

12. LFDCP-12 is located on 261 Diesel Generator Bldg elevation at column line C/2. Fire detectors are also located inside the "A" and "B" Diesel Generator Bldg. Detection devices consist of 135EF and 194EF thermal detectors, Ionization type smoke detectors, ultraviolet flame detectors and handpull stations.

4.5 LFDCP Description (continued)

The following zones make up LFDCP-12 detection:

Zone	Type Detection
1-86	Thermal 194EF, Handpull Station (Dual Action), U-V detector "A" Diesel

Zone	Type Detection
1-87	Thermal, Handpull Station (Dual Action) "A" Diesel
1-88	Ionization, Thermal "A" Diesel
1-89	Thermal 194EF, Handpull Station (Dual Action), U-V detector "B" Diesel
1-90	Thermal, Handpull Station (Dual Action) "B" Diesel
1-91	Ionization, Thermal "B" Diesel
1-176	Duct Detector Ionization
1-177	Duct Detector Ionization

Deluge action from thermal loop only all zones. Multi-cycle deluge actuation, z 1-86, 1-87, 1-89 and 1-90. Zones 1-88 and 1-91 are the only loops on site that combine a thermal and ionization detector in the same loop. Zones 1-88 and 1-91 were originally ionization loops thus no deluge action is initiated from these zones.

CAUTION

Do not direct a light source directly into the lens of the ultraviolet detector. Use only approved test light source when checking operation.

2166-B-401 Sh. 9601-9607
1364-33590 1364-31113

13. LFDCP-13 is located on 261 RAB elevation at column L/43. Fire detectors are all located in the Fuel Handling Bldg on all elevations. Detection devices consist of thermal detectors, Ionization type smoke detectors, and handpull stations.

4.5 LFDCP Description (continued)

The following zones make up LFDCP-13 detection:

Zone	Type Detection
1-73	Thermal, Handpull Station (Dual Action)
1-74	Thermal, Ionization, Handpull Station (Dual Action)
1-75	Thermal, Ionization, Handpull Station (Dual Action)
1-76	Ionization, Handpull Station (Single Action)
1-77	Ionization
1-78	Handpull Station (Single Action)
1-114	Handpull Station (Single Action)
1-115	Handpull Station (Single Action)
1-116	Handpull Station (Single Action)
1-117	Ionization, Handpull Station (Single Action)
1-128	Fire Detection Pnl FHB K Area
1-162	Duct Detector Ionization
1-163	Duct Detector Ionization
1-164	Duct Detector Ionization
1-165	Duct Detector Ionization
1-182	Door Monitor Pnl #3 (ABANDONED IN PLACE)

Deluge action from thermal loop only all zones. Multi-cycle deluge actuation z 1-73, 1-74, 1-75.

2166-B-401 Sh. 9610-9618
1364-32896 1364-29192 & 29193

14. LFDCP-14 is located on 242 Diesel Fuel Oil Storage Tank Bldg elevation at N205 25.75'/W1900. Fire detectors are located in the area of LFDCP-14. Detection devices consist of thermal detectors, handpull stations, ultraviolet flame detectors.

4.5 LFDCP Description (continued)

The following zones make up LFDCP-13 detection:

Zone	Type Detection
1-92	Thermal, U-V Flame Det. Handpull Station (Dual Action)
1-93	Thermal, U-V Flame Det. Handpull Station (Dual Action)
1-94	Thermal, U-V Flame Det. Handpull Station (Dual Action)
1-95	Thermal, U-V Flame Det. Handpull Station (Dual Action)
1-100	U-V Flame Det. Handpull Station (Single Action)

Deluge action from thermal loop only all zones. Multi-cycle deluge actuation z 1-92, 1-93, 1-94, 1-95.

CAUTION

Do not direct a light source directly into the lens of the ultraviolet detectors. Use only approved test light source when checking operation.

2166-B-401 Sh. 9621-9632
1364-32897 1364-29191

15. LFDCP-15 is located on 246 Waste Process Bldg elevation at column line Ly-My/6. Fire detectors are located in the Waste Processing Building all elevations. Detection devices consist of thermal detectors, handpull stations, and Ionization type smoke detectors.

The following zones make up LFDCP-15 detection:

Zone	Type Detection
1-101	Ionization, Handpull Stations (Single Action) 216 elev.
1-102	Ionization, Handpull Stations (Single Action) 211 elev.
1-103	Ionization, Handpull Station (Single Action) 246 elev., 236 elev. LGP-2 Sh. 9515

4.5 LFDCP Description (continued)

Zone	Type Detection
1-104	Ionization, Handpull Station (Dual Action) 261 elev.
1-105	Ionization, Handpull Station (Single Action) 276 elev.
1-106	Ionization, Thermal, Handpull Station (Dual Action) 291 elev.
1-107	Ionization, Handpull Station (Single Action) 236 elev.
1-108	Ionization, Handpull Station (Single Action) 236 elev.
1-109	Ionization, Handpull Station (Single Action) 236 elev.
1-110	Ionization, Handpull Station (Single Action) 261 elev.
1-111	Ionization, Handpull Station (Single Action) 261 elev.
1-112	Handpull Station (Double Action) 276 elev.
1-113	Ionization, Handpull Station (Single Action) 291 elev.
1-118	Ionization, Handpull Station (Single Action) 211 elev.
1-119	Ionization, Handpull Station (Single Action) 211 elev.
1-167	Duct Detector Ionization
1-168	Duct Detector Ionization
1-169	Duct Detector Ionization
1-170	Duct Detector Ionization
1-171	Duct Detector Ionization
1-172	Duct Detector Ionization
1-173	Duct Detector Ionization
1-187	Ionization Handpull Station (Single Action) 276 Elev.

4.5 LFDCP Description (continued)

Preaction deluge action from thermal loops only zone 1-106.

2166-B-401 Sh. 9501-9515
1364-34725 1364-32769-32773

16. LFDCP-16 is located on 261 Security Bldg. column 3/Da. Fire detectors are located inside the Security Bldg. Outlaying bldgs annunciate through the Security Bldg LFDCP-16. Detection devices consist of 135EF thermal detectors, Ionization type smoke detectors, ultraviolet flame detectors, and handpull stations.

The following zones make up LFDCP-16 detection:

Zone	Type Detection
1-132	Paint/Cont. Equip. Storage (Simplex)
1-133	Chemical Storage (Simplex)
1-134	Service Bldg. (Simplex)
1-135	Admin. Bldg. (Simplex)
1-136	Stores Rec. Bldg. (Simplex)
1-138	Mobile Equip. Shop (Simplex)
1-139	Warehouse 1 & 2 (Simplex)
1-140	Handpull Stations (Single Action)
1-141	Ionization, Handpull Station (Single Action) LGP-4 Sh. 9666
1-142	Thermal, Handpull Station (Single Action) U V Detector
1-143	Ionization, Thermal, Handpull Station (Dual Action)
1-144	Ionization, Thermal
1-145	Ionization, Thermal, Handpull Station (Dual Action)
1-146	Ionization, Thermal, Handpull Station (Dual Action)
1-147	Ionization, Thermal, Handpull Station (Dual Action)

4.5 LFDCP Description (continued)

Zone	Type Detection
1-148	Ionization
1-174	Duct Detector Ionization
1-175	Duct Detector Ionization

Preaction deluge action from thermal loops only zones 1-142, 1-143, 1-144, 1-145, 1-146, and 1-147. Zones 1-130A, 1-130B, 1-131A and 1-131B are zones from LFDCP-17.

2166-B-401 Sh. 9651-9665
1364-51934 1364-52808-52908

17. LFDCP-17 is located on 262 Emerg. Service Water Intake Structure. Fire detectors are located inside the ESWIS. Detection devices consist of Ionization type smoke detectors, ultraviolet flame detectors, and handpull stations.

The following zones make up LFDCP-17 detection:

Zone	Type Detection
1-130A	Ionization, Handpull Station (Single Action)
1-130B	U V Detector, Handpull Station (Single Action)
1-131A	Ionization, Handpull Station (Single Action)
1-131B	U V Detector, Handpull Station (Single Action)

Zones 1-130A, 1-130B, 1-131A, and 1-131B have redundant zone annunciations at LFDCP-16 as well as at the MFDIC. No deluge action takes place at LFDCP-17.

2166-B-401 Sh. 9641-9642
1364-53013 1364-52909

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

1. Power for the motor-driven fire pump is supplied from a 480 V power center (1-4A101 comp. 5A) the normal supply coming from a 6.9 KV switchgear and the alternate through a bus tie with another 6.9 KV switchgear.

5.1 Systems required for Support (continued)

2. The jockey fire pump's electric power supply is a 480 V power source (MCC-1-4A1012 comp. 1BR).

3. Power for the majority of the Main Fire Detection Information Center (MFDIC) equipment, the Local Fire Detection Control Panels (LFDCPs) and associated fire suppression equipment is supplied from the non-nuclear safety related balance of plant 60 KVA Static Uninterruptible Power Supply. The 60 KVA UPS system in turn is supplied from non-Class 1E motor control centers (MCCs). In the event of loss of off-site power, the station 250 volt DC battery, which is capable of supplying the 60 KVA inverter for 3 hours, is connected via the 250 volt Bus DP-1-250 to the 60 KVA static UPS system. Bus DP-1-250 is also connected via battery chargers to the Class 1E emergency diesel generator manual load block.

4. The MFDIC Hard-Wired Annunciator, LFDCP 16-1, LFDCP 16-2 and LFDCP-17 are powered from the non-safety related security system 75 KVA Static Uninterruptible Power Supply. The 75 KVA UPS system in turn is supplied from the non-Class 1E motor control center (MCC) 1-4A91, which is fed from General Service Bus 1-4A. In the event of loss of off-site power, the security system 125 volt DC battery is connected via the 125 volt Bus 1-4C to the 75 KVA static UPS system. Bus 1-4C is also connected via a battery charger to MCC 1-4A91 which can be fed from Auxiliary Diesel Generator 1C.

5. In the event of a fire, the alignment of the associated HVAC will be in accordance with the plant procedures. See the individual HVAC system description for information.

5.2 System-to-System Cross Tie

1. One system-to-system cross tie is for the make-up for the HVAC chiller in the WPB. The maximum demand from the HVAC chiller make-up will be approximately 10 gpm, which is within the capabilities of the jockey pump.

2. Emergency Service Water Systems supplies water to the post SSE Fire Protection Standpipe header via the discharge of the ESW Booster 1A-SA and 1B-SB. This arrangement provides sufficient TDH to supply the two most remote hose stations with 75 gpm (each) of water at approximately 65 psig. The seismic check valves prevent outflow to other portions of the fire protection water distribution system.

6.0 TABLES

6.1 Fire Detection System Power Supply List

7.0 FIGURES

7.1 Fire Protection Flow Diagram (Outside Area)

7.2 Fire Protection Flow Diagram (Power Block)

8.0 REFERENCES

8.1 Drawings

8.2 Specifications

8.3 Technical Manual

8.4 Miscellaneous

6.1 Fire Detection System Power Supply List

FIRE PANEL AND LOCATION	POWER FEED IDENTIFICATION	CWD 2166-B-401 SHEET	POWER FEED REFERENCE DOCUMENT
LFDCP-1 RAB EL.236	UPP-1A VITAL CKT. #26	9526	2166-B-041 SHEET 680
LFDCP-2 RAB EL.216	UPP-1A VITAL CKT. #3	9533	2166-B-041 SHEET 680
LFDCP-3 RAB EL.216	UPP-1A VITAL CKT. #4	9538	2166-B-041 SHEET 680
LFDCP-4 RAB EL.236	UPP-1A VITAL CKT. #5	9542	2166-B-041 SHEET 680
LFDCP-5 RAB EL.261	UPP-1A VITAL CKT. #6	9550	2166-B-041 SHEET 680
LFDCP-6 RAB EL.286	UPP-1A VITAL CKT. #7	9557	2166-B-041 SHEET 680
LFDCP-7-1 RAB EL.305	UPP-1A VITAL CKT. #8	9563	2166-B-041 SHEET 680
LFDCP-7-2 RAB EL.305	UPP-1A VITAL CKT. #38	9567	2166-B-041 SHEET 680
LFDCP-8 TGB EL.240	UPP-1A VITAL CKT. #9	9569	2166-B-041 SHEET 680
LFDCP-9-1 TGB EL.261	UPP-1A VITAL CKT. #10	9573	2166-B-041 SHEET 680
LFDCP-9-2 TGB EL.261	UPP-1A VITAL CKT. #28	9579	2166-B-041 SHEET 680
LFDCP-10 TGB EL.286	UPP-1A VITAL CKT. #11	9588	2166-B-041 SHEET 680
LFDCP-11 TGB EL.261	UPP-1A VITAL CKT. #12	9593	2166-B-041 SHEET 680
LFDCP-12 DGB EL.261	UPP-1A VITAL CKT. #13	9601	2166-B-041 SHEET 680
LFDCP-13-1 FHB EL.261	UPP-1A VITAL CKT. #14	9610	2166-B-041 SHEET 680
LFDCP-13-2 FHB EL.261	UPP-1A VITAL CKT. #37	9618	2166-B-041 SHEET 680
LFDCP-14-1 DFOSB EL.242	UPP-1A VITAL CKT. #15	9621	2166-B-041 SHEET 680
LFDCP-14-2 DFOSB EL.242	UPP-1A VITAL CKT. #32	9627	2166-B-041 SHEET 680
LFDCP-15-1 WPB EL.246	UPP-1A VITAL CKT. #16	9501	2166-B-041 SHEET 680
LFDCP-15-2 WPB EL.246	UPP-1A VITAL CKT. #30	9513	2166-B-041 SHEET 680
LFDCP-16-1 SECURITY BLDG.	UPP-1-4C4 CKT. #23	9651	2166-B-041 SHEET 735

6.1 Fire Detection System Power Supply List

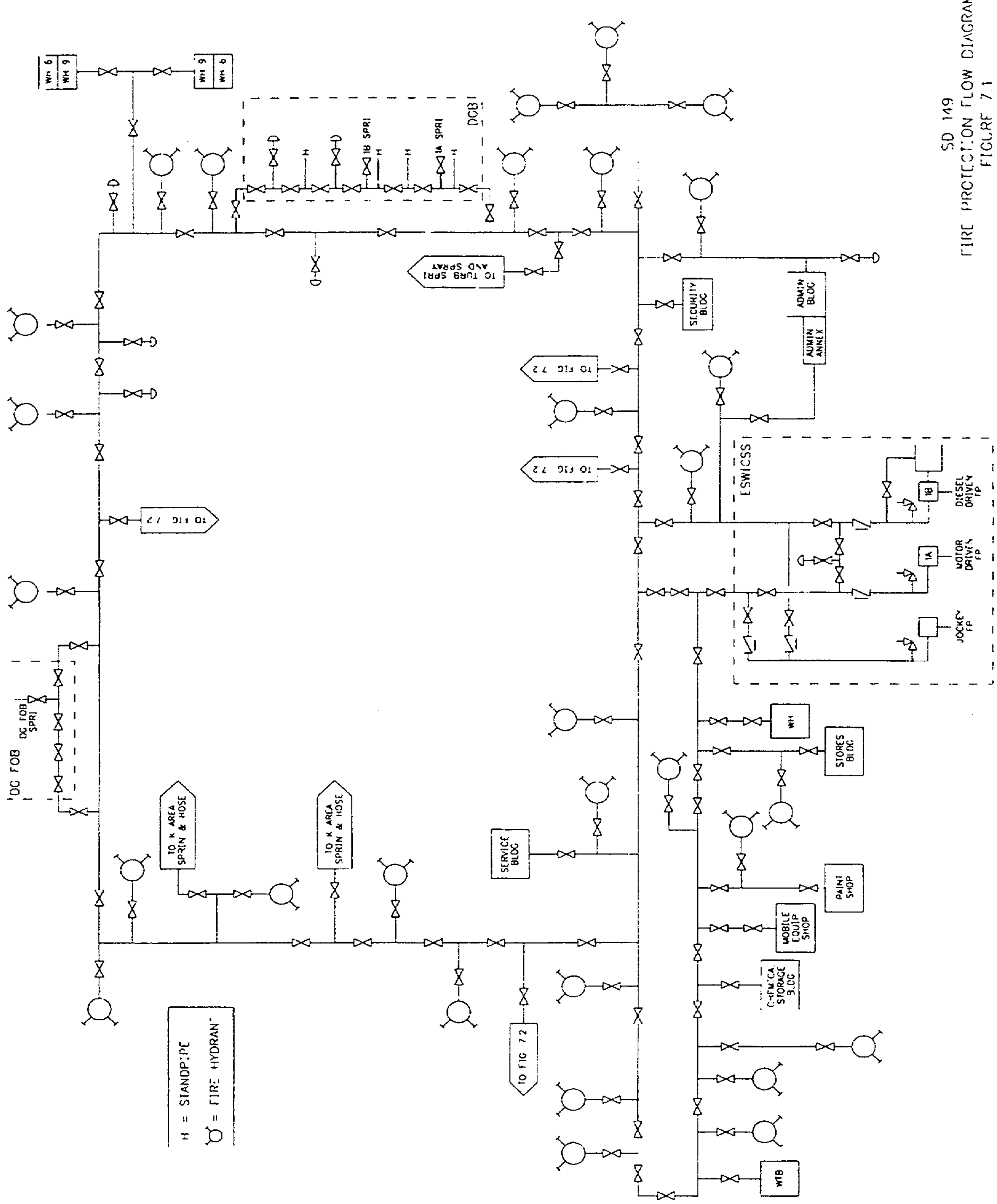
FIRE PANEL AND LOCATION	POWER FEED IDENTIFICATION	CWD 2166-B-401 SHEET	POWER FEED REFERENCE DOCUMENT
LFDCP-16-2 SECURITY BLDG.	UPP-1-4C4 CKT. #24	9661	2166-B-041 SHEET 735
LFDCP-17 ESWIS EL.262	UPP-1-4C10 CKT. #17	9641	2166-B-041 SHEET 736
MFDIC/CENTRAL CONTROL UNIT (CCU) RAB EL.317	UPP-1 CKT. #14	9517	2166-B-041 SHEET 643
MFDIC/DISPLAY CONSOLE PC RAB EL.317	UPP-1-1 CKT. #20	9517	2166-B-041 SHEET 706
MFDIC HARD-WIRED ANNUNCIATOR RAB EL.317	UPP-1-4C3 CKT. #15	9518	2166-B-041 SHEET 731
FIRE ALARM CONTROL PNL. 1 (ELEVATOR #1) WPB EL.216	PP-1-4B31-1 CKT. #41	9667	2166-B-041 SHEET 635
FIRE ALARM CONTROL PNL. 2 (ELEVATOR #2) WPB EL.216	PP-1-4B31-1 CKT. #42	9668	2166-B-041 SHEET 635
FIRE ALARM CONTROL PNL. 3 (ELEVATOR #5) FHB EL.261	LP-505 CKT. #16	9669	2166-B-047 SHEET 505
FIRE ALARM CONTROL PNL. 4 (ELEVATOR #9) FHB EL. 261	LP-520 CKT. #11	9670	2166-B-047 SHEET 520
FIRE ALARM CONTROL PNL. 5 (ELEVATOR #1C) RCB EL.236	LP-103 CKT. #21	9671	2166-B-047 SHEET 103
1SFD-E004 (PYROTRONICS SYSTEM 3) OPERATIONS BUILDING	PANEL B CKT. #24	9673	D0467
1SFD-E005 (SIMPLEX) PAINT SHOP-STORAGE BLDG.	LP-645 CKT. #8	9674A	2166-B-047 SHEET 645
1SFD-E006 (SIMPLEX) CHEMICAL STORAGE BLDG.	LP-640 CKT. #4	9675A	2166-B-047 SHEET 640

6.1 Fire Detection System Power Supply List

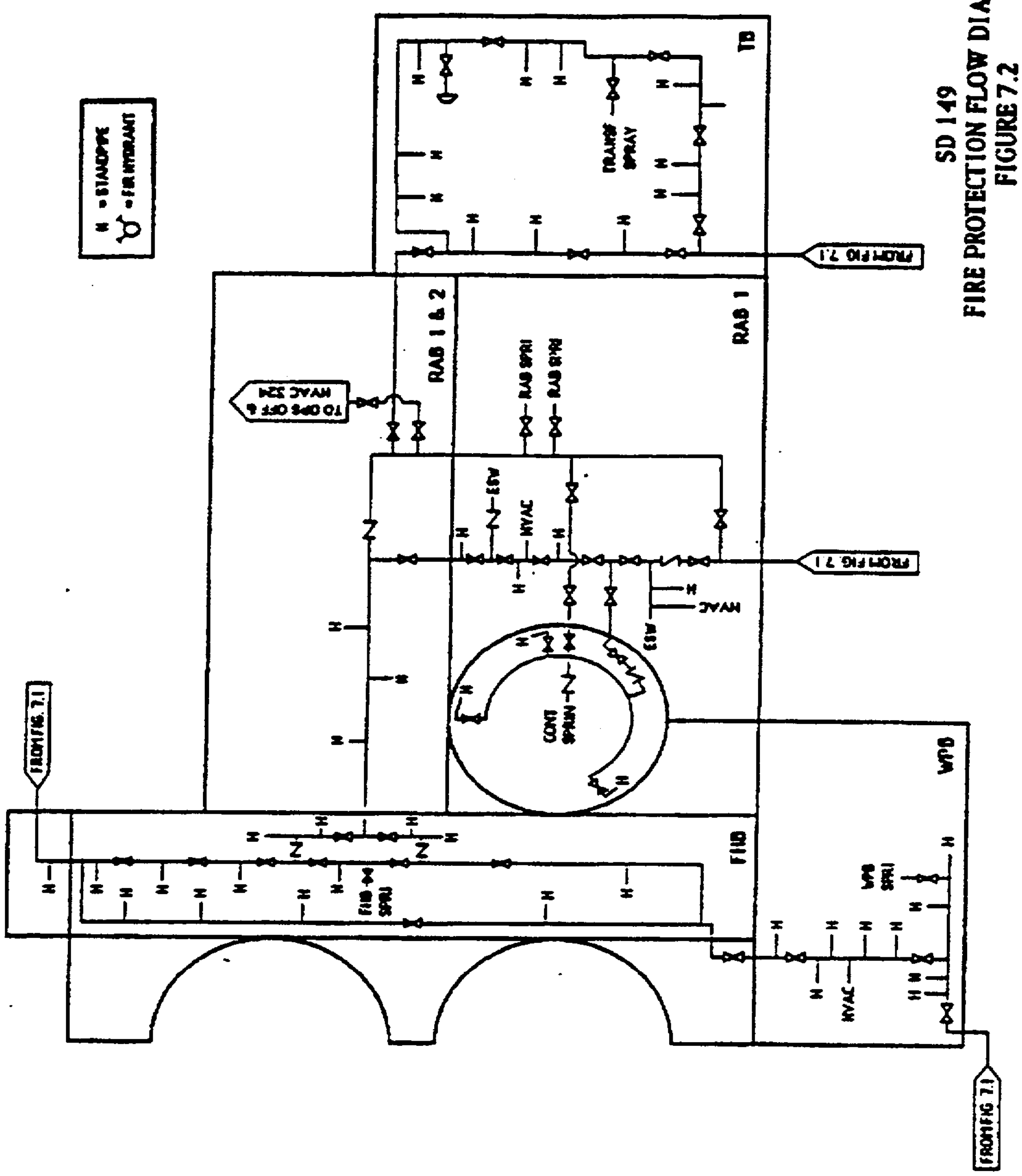
FIRE PANEL AND LOCATION	POWER FEED IDENTIFICATION	CWD 2166-B-401 SHEET	POWER FEED REFERENCE DOCUMENT
1SFD-E007 (SIMPLEX) SERVICE STOCKROOM BLDG	LP-634 CKT. #36	9676A	2166-B-047 SHEET 634UPP-1A VITAL CKT. #37
1SFD-E008 (SIMPLEX) ADMINISTRATION BUILDING	PANEL B CKT. #8	9677A	RCD-1636
1SFD-E009 (SIMPLEX) STORES RECEIVING BLDG	LP-648 CKT. #7	9678A	2166-B-047 SHEET 648
1SFD-E010 (SIMPLEX) TURBINE STORAGE BLDG.	PANEL A CKT. #15	9650A	HNP-638-E-3000
1SFD-E011 (SIMPLEX) MOBILE EQUIP. SHOP	LP-643 CKT. #9	9679A	2166-B-047 SHEET 643
1SFD-E012 (SIMPLEX) WAREHOUSE	LP-650 CKT. #12	9680A	2166-B-047 SHEET 650
1SFD-E056 (SIMPLEX 2120- MAIN ALR. PNL) FHB K AREA EL.261	PANEL LPE CKT. #18	9516	D-3131 D-3142 D-3144 D-3145
1SFD-E057 (SIMPLEX 2120- TRANSPONDER) FHB K AREA EL. 261	PANEL LPE CKT. #18	9520A	D-3131 D-3142 D-3144 D-3145
1SFD-E058 (SIMPLEX 2120- TRANSPONDER) FHB K AREA EL. 272	PANEL LPE CKT. #20	9523A	D-3131 D-3142 D-3144 D-3145
1SFD-E059 (SIMPLEX 2120- TRANSPONDER) FHB K AREA EL. 286	PANEL LPE CKT. #22	9524A	D-3131 D-3142 D-3144 D-3145
1SFD-E060 (SIMPLEX 2120- TRANSPONDER) FHB K AREA EL. 305	PANEL LPE CKT. #24	9525A	D-3131 D-3142 D-3144 D-3145

6.1 Fire Detection System Power Supply List

FIRE PANEL AND LOCATION	POWER FEED IDENTIFICATION	CWD 2166-B-401 SHEET	POWER FEED REFERENCE DOCUMENT
1SFD-E061 (SIMPLEX 2120-TRANSPONDER) FHB K AREA EL. 324	PANEL LPE CKT. #26	9532A	D-3131 D-3142 D-3144 D-3145
1SFD-E062 (SIMPLEX 2120-TRANSPONDER) FHB M AREA EL. 216	PANEL LPE CKT. #17	9536A	D-3131 D-3142 D-3144 D-3145
1SFD-E063 (SIMPLEX 2120-TRANSPONDER) FHB M AREA EL. 236	PANEL LPE CKT. #15	9537A	D-3131 D-3142 D-3144 D-3145
1SFD-E064 (SIMPLEX 2120-TRANSPONDER) FHB M AREA EL. 261	PANEL LPE CKT. #30	9541A	D-3131 D-3142 D-3144 D-3145
1SFD-E065 (SIMPLEX 2120-TRANSPONDER) FHB H AREA EL. 216	PANEL LPE CKT. #28	9572A	D-3131 D-3142 D-3144 D-3145
1SFD-E066 (SIMPLEX 2120-TRANSPONDER) FHB K & M AREA EL. 261	PANEL LPE CKT. #4	9587	D-3131 D-3142 D-3144 D-3145
1SFD- E067 (SIMPLEX 2120-TRANSPONDER) FHB K & M AREA EL. 261	PANEL LPE CKT. #30	9587 9541A	D-3131 D-3142 D-3144 D-3145
1SFD-E068 (SIMPLEX 2120-TRANSPONDER) FHB K AREA EL. 236	PANEL LPE CKT. #16	9592A	D-3131 D-3142 D-3144 D-3145



SD 149
FIRE PROTECTION FLOW DIAGRAM
FIGURE 7.1



SD 149
FIRE PROTECTION FLOW DIAGRAM
FIGURE 7.2

8.1 Drawings

Drawing No.	Title
2178-G-0004	General Arrangement Turbine Bldg Plan El. 240.0
2165-G-0005	General Arrangement Turbine Bldg Ground Floor Plan
2165-G-0006	General Arrangement Turbine Bldg Mezzanine Floor Plan
2165-G-0007	General Arrangement Turbine Bldg Operating Floor Plan
2165-G-0008	General Arrangement Turbine Bldg Section Sh. 1
2165-G-0009	General Arrangement Turbine Bldg Section Sh. 2
2165-G-0010	General Arrangement Reactor Auxiliary Bldg, Plan El. 324.00
2165-G-0011	General Arrangement Containment Bldg Plan El. 221.00 & 236.00
2165-G-0012	General Arrangement Containment Bldg Plan El. 261.00 & 286.00
2165-G-0013	General Arrangement Containment Bldg Section Sh. 1
2165-G-0014	General Arrangement Containment Bldg Section Sh. 2
2165-G-0015	General Arrangement Reactor Auxiliary Bldg Plan El. 190.00 & 216.00
2165-G-0016	General Arrangement Reactor Auxiliary Bldg Plan El. 236.00
2165-G-0017	General Arrangement Reactor Auxiliary Bldg Plan El. 261.00
2165-G-0018	General Arrangement Reactor Auxiliary Bldg Plan El. 286.00
2165-G-0019	General Arrangement Reactor Auxiliary Bldg Plan El. 305.00
2165-G-0020	General Arrangement Reactor Auxiliary Bldg Section Sh. 1
2165-G-0021	General Arrangement Reactor Auxiliary Bldg Plan Sh. 2
2165-G-0022	General Arrangement Fuel Handling Bldg Plan Sh. 1
2165-G-0023	General Arrangement Fuel Handling Bldg Plan Sh. 2
2165-G-0024	General Arrangement Fuel Handling Bldg Section Sh. 1
2165-G-0025	General Arrangement Fuel Handling Bldg Section Sh. 2
2165-G-0026	General Arrangement Fuel Handling Bldg Section Sh. 3
2165-G-0033	General Arrangement Tank Area Plans & Sections Units 1 & 2
2165-G-0036 S01	General Arrangement Diesel Generator Bldg Plan

8.1 Drawings (continued)

Drawing No.	Title
2165-G-0036 S02	General Arrangement Diesel Generator Bldg Sections
2165-G-0055	Flow Diagram-Fire Protection System Sh. 1
2165-G-0056	Flow Diagram-Fire Protection System Sh. 2
2165-G-0057	Flow Diagram-Fire Protection System Sh. 3
2165-G-0194 S01	Diesel Generator Building Piping Plan Sh. 1
2165-G-0194 S02	Diesel Generator Building Piping Sections
2165-G-0194 S03	Diesel Generator Bldg Piping Plan Sh. 2
2165-G-0196 S02	Fire Protection Piping Turbine Bldg Plans & Sections Sh. 2
2165-G-0197 S01	Fire Protection Piping-Reactor Auxiliary Bldg Plan
2165-G-0197 S02	Fire Protection Piping-Reactor Auxiliary Bldg Plan & Sections
2165-G-0197 S03	Fire Protection Piping System-Reactor Auxiliary Bldg Sections
2165-G-0200	Fire Protection Piping-Containment Bldg
2165-G-0205	Emergency Service Water & Cooling Tower Make-up Intake Structure Piping Plans & Sect.
2165-G-0209	Emergency Service Water Intake Screening Structure Piping
2165-G-0210 S01	Yard Piping Partial Plans & Sections Sh. 7
2165-G-0210 S02	Yard Piping Plans Sh. 3
2165-G-0211	Yard Piping Plans Sh. 1
2165-G-0212	Yard Piping Partial Plans & Sections Sh. 2
2165-G-0213	Yard Piping Partial Plans & Sections Sh. 2
2165-G-0214	Yard Piping-Diesel Oil Storage Tank Area Plans & Sections
2165-G-0215	Yard Piping Partial Plans & Sections Sh. 3
2165-G-0216	Yard Piping Partial Plans & Sections Sh. 4
2165-G-0217	Yard Piping Partial Plans & Sections Sh. 5
2165-G-0218	Yard Piping Plans Sh. 2

8.1 <u>Drawings</u> (continued)

Drawing No.	Title
2165-G-0219	Yard Piping Partial Plans & Sections Sh. 6
2165-G-0220	Water Treatment Bldg Piping
2165-G-0221	Water Treatment Bldg Plans & Sections Sh. 2
2165-G-0249	Composite Piping Reactor Auxiliary Bldg Tank Area Sections & Partials
2165-G-0250	Composite Piping Reactor Auxiliary Bldg Tank Area Plans
2165-G-0251	Composite Piping Reactor Auxiliary Bldg Tank Area Sections
2165-G-0253	Fuel Handling Building Piping Plan-El. 216.00 & 261.00
2165-G-0254	Fuel Handling Building Piping Plan-El. 236.00 Sh. 1
2165-G-0255	Fuel Handling Building Piping Plan-El. 236.00 Sh. 2
2165-G-0256	Fuel Handling Building Piping Plan-El. 286.00 Sh. 1
2165-G-0257	Fuel Handling Building Piping Sections-Sh. 1
2165-G-0258	Fuel Handling Building Piping Sections-Sh. 2
2165-G-0259	Fuel Handling Building Piping Sections-Sh. 3
2165-G-0260	Fuel Handling Building Piping Sections-Sh. 4
2165-G-0261	Fuel Handling Building Piping Sections-Sh. 5
2165-G-0262	Fuel Handling Building Piping Sections-Sh. 6
2165-G-0264	Fuel Handling Building Misc. Plans & Sections
2165-G-0266	Fuel Handling Building Piping Plan El. 286.00 Sh. 2
2165-G-0388	Flow Diagram-Fire Protection System-Sh. 4
2165-G-0406	Flow Diagram-Fire Protection Sprinkler Systems Un. 1 & Misc. Bldgs Sh. 5
2165-G-0910	General Arrangement Waste Processing Bldg Plan at El. 211.00 & 216.00
2165-G-0911	General Arrangement Waste Processing Bldg Plan at El. 236.00
2165-G-0912	General Arrangement Waste Processing Bldg Plan El. 261.00
2165-G-0913	General Arrangement Waste Processing Bldg Plan El. 276.00

8.1 Drawings (continued)

Drawing No.	Title
2165-G-0914	General Arrangement Waste Processing Bldg Plan at El. 286.00 & 291.00
2165-G-0916	General Arrangement Waste Processing Sections Sh. 1
2165-G-0917	General Arrangement Waste Processing Bldg Sections Sh. 2
2165-G-0918	General Arrangement Waste Processing Bldg Sections Sh. 3
2165-G-0991	Utility & Service Piping-Waste Processing Bldg. El. 211.00 Sh. 1
2165-G-0992	Utility & Service Piping-Waste Processing Bldg. El. 211.00 Sh. 2
2165-G-0993	Utility & Service Piping-Waste Processing Bldg. El. 211.00 Sh. 3
2165-G-0994	Utility & Service Piping-Waste Processing Bldg. El. 236.00 Sh. 1
2165-G-0995	Utility & Service Piping-Waste Processing Bldg. El. 236.00 Sh. 2
2165-G-0996	Utility & Service Piping-Waste Processing Bldg. El. 236.00 Sh. 3
2165-G-0997	Utility & Service Piping-Waste Processing Bldg. El. 261.00
2165-G-0998	Utility & Service Bldg-Waste Processing El. 276.00
2165-G-0999	Utility & Service Piping-Waste Processing Bldg. El. 291.00
2165-S-0001 S01	Diesel Generator Bldg-Fire Suppression System-El. 261.00
2165-S-0001 S02	Diesel Generator Bldg-Fire Suppression System-El. 261.00-Pipe Supp. Loc.
2165-S-0001 S03	Diesel Generator Bldg-Fire Suppression System-El. 261.00 Pipe Supp. Loc.
2165-S-0002	Diesel Fuel Oil Storage Tank Bldg-Fire Suppression System
2165-S-0006 S01	Diesel Gen. Bldg & Fuel Oil Storage-Fire Protection Sprinkler Equipment
2165-S-0006 S02	Diesel Gen. Bldg & Fuel Oil Storage-Fire Protection Sprinkler Equipment

8.1 Drawings (continued)

Drawing No.	Title
2165-S-0006 S03	Diesel Gen. Bldg & Fuel Oil Storage-Fire Protection Sprinkler Equipment
2165-S-0555	Simplified Flow Diagram-Fire Protection
2165-S-0556	Simplified Flow Diagram-Fire Protection
2165-S-0557	Simplified Flow Diagram-Fire Protection
2165-S-0888	Simplified Flow Diagram-Containment Bldg Fire Protection
2165-S-0906	Simplified Flow Diagram-Fire Protection Sprinkler System
2165-S-0906 S01	Fire Protection Flow Diagram
2165-S-0906 S02	Fire Protection Flow Diagram
2165-S-0906 S03	Fire Protection Flow Diagram
2165-S-2252	Cont. Bldg-Fire Prot. Zone 1C-1-286 & 1C-2-261, System G. Elev. 261 & 286
2165-S-2253	Cont. Bldg-Fire Prot. Zone 1C-1-236, System G, El. 236
2167-S-0002	Interior Walls, El. 190.00
2167-S-0003	Composite Penetrations, El. 216.00
2167-S-0004	Shear Wall, Col. Line 15
2167-S-0005	RAB, Penetration Seal Identification, Shear Wall Col. 39
2167-S-0006	RAB, Penetration Seal Identification, H-line Wall
2167-S-0007	RAB Shear Wall, Composition Penetrations
2167-S-0008	RAB Composite Penetrations, Plan B, El. 236.00
2167-S-0009	FHB & Aux. Bldg, Shear Walls
2167-S-0010	South Wall, Composite Penetrations
2167-S-0011	RAB, Plan A, El. 236.00 Interior Walls
2167-S-0012	RAB, Plan A, El. 236.00 & 247.00
2167-S-0013	RAB, Composite Penetrations, Plan B, El. 261.00
2167-S-0014	RAB, Composite Penetrations, Plan A, El. 261.00

8.1 Drawings (continued)

Drawing No.	Title
2167-S-0015	RAB, Interior Walls, El. 261.00
2167-S-0016	RAB, Penetration Seal Identification, Pipe Tunnel Walls
2167-S-0017	East Wall, Composition Penetrations
2167-S-0018	RAB, Composite Penetrations, El. 324.00, Roof Plans, Cols. 36-39
2167-S-0019	Composite Penetrations, Plan B, El. 286.00
2167-S-0020	Composite Penetrations, Plan A, El. 286.00
2167-S-0021	RAB, Composite Penetrations, Plan D, El. 261.00
2167-S-0023	RAB, Composite Penetrations, El. 236.00, Plan E; El. 286.00 Plan C
2167-S-0024	RAB, Penetration Seal Identification, Plan D, El. 286.00
2167-S-0025	RAB, Penetration Seal Identification, Plan A, El. 305.00
2167-S-0026	RAB, El. 305.00
2167-S-0027	Plan D, El. 305.00
2167-S-0028	RAB, Interior Walls, El. 305.00. Plans A & B
2167-S-0029	FHB & RAB, Plan J, El. 324.00
2167-S-0030	FHB & Aux. Bldg, Plan J, El. 305.00
2167-S-0031	Interior Wall, Composite Penetrations, East Wall, El. 216.00
2167-S-0032	RAB, El. 261.00, Interior Walls
2167-S-0033	Interior Walls, RAB, El. 261.00
2167-S-0034	RAB, El. 324.00, Plan D
2167-S-0035	RAB, East Wall Penetrations
2167-S-0036	RAB, Interior Walls, El. 236.00
2167-S-0037	RAB, Interior Walls, El. 286.00
2167-S-0038	RAB, Interior Walls, El. 286.00

8.1 Drawings (continued)

Drawing No.	Title
2167-S-0039	Shear Walls Composite Penetrations
2167-S-0040	Misc. Plans, Sections, & Details
2167-S-0041	Interior Walls, RAB, El. 236.00
2167-S-0042	RAB, El. 305.00, Interior Walls
2167-S-0043	Interior Walls, RAB, El. 305.00
2167-S-0044	RAB, El. 324.00, Roof, Plan C
2167-S-0045	WPB, El. 211.00, Interior Walls, Composite Penetrations
2167-S-0046	RAB, West Wall, Composite Penetrations
2167-S-0047	WPB, El. 211.00, Interior Walls, Composite Penetrations
2167-S-0048	RAB, El. 261.00, Interior Walls, Penetrations
2167-S-0049	WPB, El. 211.00, Interior Walls, Composite Penetrations
2167-8-0052	WPB, El. 211.00, Interior Walls, Composite Penetrations
2167-S-0053	WPB, El. 211.00, Interior Walls, Composite Penetrations
2167-S-0055	WPB, El. 211.00, Interior Walls, Composite Penetrations
2167-S-0057	WPB, Slab, El. 222.00, Composite Penetrations
2167-S-0058	WPB, Floor Slab, El. 236.00, Composite Penetrations
2167-S-0059	WPB, Floor Slab, El. 236.00, Composite Penetrations
2167-S-0060	WPB, Floor Slab, El. 236.00, Composite Penetrations
2167-S-0061	WPB, North Wall, Penetrations
2167-S-0062	WPB, North Wall, Penetrations
2167-S-0063	WPB, El. 236.00, Interior Wall Penetrations
2167-S-0064	WPB, El. 236.00, Interior Wall Penetrations
2167-S-0065	WPB, Wall at Col. Line H, Composite Penetrations
2167-S-0068	WPB, El. 236.00, Interior Wall Penetrations

8.1 Drawings (continued)

Drawing No.	Title
2167-S-0069	WPB, El. 236.00, Interior Wall Penetrations
2167-S-0070	WPB, El. 236.00, Interior Wall Penetrations
2167-9-0071	WPB, Wall at Col. Line K
2167-S-0073	WPB, Wall at Col. Line P
2167-S-0074	WPB, Wall at Col. Line S and El. 236.00 Interior Walls
2167-S-0075	WPB, Wall at Col. Line 5
2167-S-0076	WPB, Wall at Col. Line 5
2167-S-0077	WPB, Intermediate Slabs & Interior Walls, El. 236.00
2167-S-0078	WPB, Penetration Seals, Interior Walls, El. 276.00
2167-S-0079	WPB, El. 236.00 Interior Walls
2167-S-0080	WPB, Floor Slab, El. 261.00, Composite Penetrations
2167-S-0081	WPB, Floor Slab, El. 261.00, Composite Penetrations
2167-S-0082	WPB, Floor Slab, El. 261.00, Composite Penetrations
2167-S-0083	WPB, El. 261.00, Interior Walls
2167-S-0084	WPB, Floor Slab, El. 276.00, Composite Penetrations
2167-S-0085	WP8, Floor Slab, El. 276.00, Composite Penetrations
2167-S-0086	WPB, El. 276.00, Interior Walls
2167-S-0087	WPB, El. 276.00, Interior Walls
2167-S-0088	WPB, Floor Slab, El. 291.00, Composite Penetrations
2167-S-0089	WPB, Floor Slab, El. 291.00, Composite Penetrations
2167-S-0090	WPB, El. 291.00, Interior Walls
2167-S-0091	WPB, El. 291.00, Interior Walls
2167-S-0092	Containment Bldg, Penetration Seal Identification, Shield Walls, Plans & Sections
2167-S-0093	Containment Bldg, Secondary Shield Wall
2167-S-0094	FHB & RAB, El. 261.00, Plans L & M

8.1 Drawings (continued)

Drawing No.	Title
2167-S-0095	FHB & RAB, El. 216.00, Interior Walls
2167-S-0096	FHB & RAB, El. 236.00, Plan G & H
2167-S-0097	FH8 & RAB, El. 236.00, Interior Walls
2167-S-0098	FHB & RAB, El. 236.00, Interior Walls
2167-S-0099	FHB & RAB, El. 261.00, Plan G & H
2167-S-0100	FHB & RAB, EL. 236.00, Plan L & M
2167-S-0101	FHB & RAB, EL. 261.00 & Roof Plan El. 272.17
2167-S-0102	FHB & RAB, El. 261.00, Interior Walls
2167-S-0103	FHB & RAB, Shear Wall, Composite Penetrations
2167-S-0104	FHB & RAB, El. 286.00, Plan G & H
2167-S-0105	FHB, Penetration Seal Identification, Pipe Tunnel, El. 254.00
2167-S-0106	FHB & RAB, El. 286.00, Plan J
2167-S-0107	FHB & RAB, Exterior Wall Composite Penetrations
2167-S-0108	FHB & RAB, Exterior Wall Composite Penetrations
2167-S-0109	FHB & RAB, Shear Wall, Composite Penetrations
2167-S-0110	Turbine Bldg, Composite Penetrations
2167-S-0111	FHB & RAB, Shear Wall, Composite Penetrations
2167-S-0112	FHB & RAB, Shear Wall, Composite Penetrations
2167-S-0113	Turbine Bldg, El. 286.00
2167-S-0114	Emergency Service Water Screening Structure
2167-S-0115	FHB & RAB, Shear Wall, Composite Penetrations
2167-S-0116	FHB & RAB, Shear Wall, Composite Penetrations
2167-S-0117	FHB & RAB, Penetration Seal Identification, Shear Wall, Col. Line N
2167-8-0118	Diesel Generator Bldg, Composite Penetration
2167-S-0119	Diesel Generator Bldg, Composite Penetration

8.1 Drawings (continued)

Drawing No.	Title
2167-S-0120	Tank Bldg, Composite Penetrations
2167-S-0121	Tank Bldg, Composite Penetrations
2167-S-0122	Tank Bldg, Composition Penetrations
2167-S-0123	Diesel Fuel Oil Storage Tank Bldg, Penetration Seal Identification
2167-S-0124	Turbine Building Interior Walls, Composite Penetrations
2167-S-0125	Turbine Building, Ground Floor Slab, Composite Penetrations
2167-S-0126	WPB Control Room, El. 246.00, Composite Penetration Seal Identification
2167-S-0127	WPB Pipe Tunnels, El. 228.00, Composite Penetrations
2167-S-0128	WPB, South Wall, Composite Penetrations
2167-S-0129	WPB, Connecting Pipe Tunnels
2167-S-0130	WPB, Connecting Pipe Tunnels, El. 313.00
2167-S-0131	Emergency Service Water Intake Structure, Composite Penetrations
2167-S-0133	Fuel Handling, El. 286.00, Plan K, and Unloading Area
2167-S-0134	Fuel Handling, El. 286.00, Plan L & M
2167-S-0135	FHB & RAB, Penetration Seal Identification, Shear Wall, Col. Line I
2167-S-0136	RAB, Composite Penetrations, El. 261.00, Plans C & D, Cols. 43 to 45
2167-S-0137	Cable Spread Room, TSI Fire Wall, El. 286.00
2167-S-0138	RAB, El. 286.00, Interior Walls
2167-S-0139	FHB, Penetration Seal Identification, El. 286.00
2167-S-0140	RAB, Penetration Seal Identification, Col. Line 41
2167-S-0141	RAB, Penetration Seal Identification, Col. Line 45
2167-S-0142	Tech. Support Center, FHB, Communication & HVAC Room, El. 324.00 Stairway

8.1 Drawings (continued)

Drawing No.	Title
2167-S-0143	FHB, Plan K, El. 337.00
2167-S-0144	FHB, Exterior Shear Wall, Col. Line N
2167-S-0145	FHB, Exterior Shear Wall, Col. Line N
2167-S-0146	FHB, Exterior Shear Wall, Col Line Mx
2167-S-0147	FHB Unloading Area, Composite Penetration Seal, El. 261.00, Plans & Sections
2167-S-0148	FHB, Plan K, El. 261.00 & Roof, El. 272.17
2167-S-0149	Turbine Bldg, Switchgear Room, El. 301.59; Exterior Wall Ay
2167-S-0150	FHB & RAB, Penetration Seal Identification, Plan J, El. 236.00
2167-S-0151	RAB Access Bays & Serv. Water Pipe Tunnel, Penthouse Penetration Seal Identification
2167-S-0152 S01	WPB Roof at El. 321.00 Penetration Seal Drawing
2167-S-0152 S02	WPB Roof at El. 321.00 Penetration Seal Drawing
2167-S-0153 S01	Cable Spread Room TSI Fire Wall Upgrades, El. 286.00
2167-S-0153 S02	RAB Elev.286 Thermo-Lag Enclosure panel layout & Installation Details
2167-S-0200	FHB & RAB, Penetration Seals, Stair A-21, & Elevator 2
2167-S-0201	FHB Composite Penetrations, Stair A-2, & Elevator 1
2167-S-0202	WPB Composite Penetrations Stairs A-33, A-34, A-35, & A-36
2167-S-0203	RAB & FHB, Seal Identification, Stairs A-4, A-6, & A-8
2167-S-0204	FHB Seal Identification Stair A-7 & Elevator 5
2167-S-0205	Turbine Bldg, Composite Penetrations, Stairs A-37 & A-41, Elevator 7
2167-S-0206	FHB Composite Penetrations Stairs A-23 & A-25, Elevator 6
2167-S-0207	RAB Composite Penetrations, Stair A-47
2167-S-0208	FHB Penetration Seal Identification, Stairs A-12, A-32, & Elevator 9
2167-S-9507	Penetration Detail Report

8.1 Drawings (continued)

Drawing No.	Title
1364-29191	Fire Detection System-Detector Location Fuel Oil Storage Tank Area
1364-29192	Fire Detection System-Detector Location Fuel Handling Bldg.
1364-29193	Fire Detection System-Detector Location Fuel Handling Bldg.
1364-31113	Fire Detector Location-Diesel Generator Bldg
1364-31116	Fire Detector Location-Turbine Bldg. El. 261.00
1364-31118	Fire Detector Location-Turbine Bldg. El 286.00
1364-31120	Fire Detector Location-Turbine Bldg. El. 240.00
1364-32768	Fire Detector Location-Transformer Yard
1364-32769	Fire Detector Location-WPB, El. 261.00
1364-32770	Fire Detector Location-WPB, El. 211.00 & 216.00
1364-32771	Fire Detector Location-WPB, El. 286.00 & 291.00
1364-32772	Fire Detector Location-WPB, El. 276.00
1364-32773	Fire Detector Location-WPB, El. 236.00 & 246.00
1364-32887	Fire Detector Location-RAB, El. 305.00 & 324.00
1364-32888	Fire Detector Location-Containment Bldg
1364-32889	Fire Detector Location-RAB, El. 261.00
1364-32890	Fire Detector Location-RAB, El. 286.00
1364-32891	Fire Detector Location-RAB, El. 236.00
1364-32892	Fire Detector Location-RAB, El. 305.00, & 324.00
1364-32893	Fire Detector Location-Containment Bldg, El. 221.00 & 261.00
1364-34173	Fire Detector Location-RAB, El. 190.00 & 216.00
1364-52808	Security Bldg-Detector Location Sh. 2
1364-52809	Security Bldg-Detector Location Sh. 1
1364-52908	Water Treatment Facility Detector Location
1364-52909	Emergency S. W. Intake Structure Detector Location
1364-90009	Fuel Handling Bldg, System H, Zone 1-4F-1-236

8.1 Drawings (continued)

Drawing No.	Title
1364-90010	Fuel Handling Bldg, System H, Zone Bulk Pipe, El. 236.00 & 261.00
1364-90011	Turbine Bldg, System M, Zone 1T-4-261, El. 261.00 Feed Pumps
1364-90012	Turbine Bldg, System N, Zone 1T-3-261, El. 261.00 Booster Pump
1364-90013	Turbine Bldg, System O, Zone 1T-1-261, El. 261.00 H2 Seal Oil Unit
1364-90014	Turbine Bldg, System K, Zone 1T-5-261, El. 261.00 Condensate Pumps
1364-90015	Turbine Bldg, System J, Zone 1T-2-261, El. 261.00 T.O. Reservoir Area
1364-90016	Turbine Bldg, System L, Zone 1T-1-286A, El. 286.00 Preaction 9-27
1364-90017	Cable Vault Room-System L, Zone 1T-1-250 Turbine Bldg, El. 250.00
1364-90018	Reactor Auxiliary Bldg, System C, Zone 1A-1-216, El. 216.00
1364-90020	Symbols for Preliminary and Working Plans
1364-90021	Containment Bldg, System G, Zone 1C-1-236, El. 236.00
1364-90022	Containment Bldg, System G, Zone 1C-4-236, El. 236.00
1364-90023	Fuel Handling Bldg, System H, Zone 1-4F-1-261, El. 261.00
1364-90024	Turbine Bldg, System I, Zone 1T-1-240, El. 240.00, HVAC Room
1364-90025	Turbine Bldg, System I, Zone 1T-1-286 B, El. 286.00 Preaction Cols. 27-43
1364-90026	Fuel Handling Bldg, System H, Zone Bulk Pipe, El. 236.00, 261.00
1364-90028	Containment Bldg, System G, Zone 1C-1-221, El. 221.00
1364-90029	Reactor Auxiliary Bldg, System A, Zone 1A-2-190, El. 190.00
1364-90030	Reactor Auxiliary Bldg, System C, Zone 1A-2-216, El. 216.00
1364-90032	Containment Bldg, System G, Bulk Pipe, El. 236.00
1364-90033	Containment Bldg, System G, Zone 1C-2-236, El. 236.00
1364-90034	Reactor Auxiliary Bldg, Bulk Pipe, System A, B, Partial C, Zone 1A-1-190, 1A-2-190, 1A-1-216
1364-90035	Reactor Auxiliary Bldg, System A, Zone 1A-1-190

8.1 Drawings (continued)

Drawing No.	Title
1364-90036	Reactor Auxiliary Bldg, System D, Zone 1A-3-261, El. 261.00
1364-90037	Containment Bldg, System G, Zone 1C-3-236, El. 261.00
1364-90038	Reactor Auxiliary Bldg, System D, Zone 1A-2-261, El. 261.00
1364-90039	Reactor Auxiliary Bldg, System B, Zone 1A-1-190, El. 190.00
1364-90040	Reactor Auxiliary Bldg, System C, Bulk Pipe, El. 236.00
1364-90041	Reactor Auxiliary Bldg, System C, Zone 1A-1-236, El. 236.00
1364-90042	Reactor Auxiliary Bldg, System D, Zone 1A-1-261, El. 261.00
1364-90043	Reactor Auxiliary Bldg, System D, Buld Piping, El. 261.00
1364-90044	Reactor Auxiliary Bldg, System D, Zone 1A-4-261, El. 261.00
1364-90045	Reactor Auxiliary Bldg, Bulk Pipe System F, Zone 1A-1-305 & 1A-2-305
1364-90046	Reactor Auxiliary Bldg, System F, Zone 1A-2-305
1364-90047	Reactor Auxiliary Bldg, System D, Zone 1A-6-261, El. 261.00
1364-90048	Reactor Auxiliary Bldg, System D, Zone 1A-5-261, EL. 261.00
1364-90049	Reactor Auxiliary Bldg, System C, Bulk Pipe, El. 236.00
1364-90050	Reactor Auxiliary Bldg, System C, Zone 1A-2-236, El. 236.00
1364-90052	Reactor Auxiliary Bldg, Bulk Pipe, System E, Zones 1A-1-286, 1A-2-286
1364-90053	Reactor Auxiliary Bldg, System C, Zone 1A-4-236, El. 236.00
1364-90054	Reactor Auxiliary Bldg, System C, Zone 1A-4-236, El. 236.00
1364-90055	Reactor Auxiliary Bldg, System E, Zone 1A-1-286, El. 286.00
1364-90056	Reactor Auxiliary Bldg, System E, Zone 1A-2-286, El. 286.00
1364-90057	Containment Bldg, System G, Zone 1C-4-261, El. 261.00
1364-90058	Containment Bldg, System G, Zone 1C-5-261, El. 261.00
1364-90059	4 in. Dia. Flanged Firecycle Valve
1364-90060	4 in. Dia. Grooved Firecycle Valve

8.1 Drawings (continued)

Drawing No.	Title
1364-90061	6 in. Dia. Firecycle Valve
1364-90062	4 in. Dia. Deluge Valve
1364-90063	6 in. Dia. Deluge Valve
1364-90064	6 in. Dia. Preaction Valve
1364-90065	4 in. Dia., 6 in. Dia., and 8 in. Dia. Swing Check Valve
1364-90066	4 in. Dia. and 6 in. Dia OS&Y Gate Valve
1364-90067	2 in. Dia. Angle Drain Valve
1364-90068	Sprinkler Auxiliary Drain Valve
1364-90069	1 in. Dia. Sprinkler Auxiliary Drain Valve
1364-93036	Penetration Seal Typicals MR-1 & MR-2
1364-93037	Penetration Seal Typicals FB-4 & FB-5
1364-93038	Penetration Seal Typicals FB-1, FB-2, & FB-3
1364-93039	Penetration Seal Typicals P-1, P2, & P-3
1364-93040	Internal conduit fire Seals EC-1 through EC-6
1364-93041	Typicals MC-1 & MC-2 Wall/Floor Mechanical Fire Seals
1364-93042	Typicals ML-1 & ML-2 Mechanical Wall/Floor Fire Seals
1364-93043	ER-1 & ER-2 Wall/Floor Electrical Fire/Radiation Seal
1364-93044	ES-1 through ES-4 Electrical Wall/Floor Fire Seals
1364-93045	MP-1 & MP-2 Wall/Floor Flexible Fire Seals
1364-93047	MR-4 through MR-8 Flexible Mechanical Radiation Seals-Radflex
1364-93048	Typical MR-3 Annulus Reducer Radiation
1364-93049	EL-1 & EL-2 Wall/Floor Electrical Fire Seals
1364-93050	Sleeve Extender Methods 1, 2, 3, & 4 (for Boot Attachment)
1364-93051	Typicals HL-1 & HL-2 Wall/Floor HVAC Fire Seals
1364-93052	Typicals GS-1 & GS-2 Seismic Gap Seals

8.1 Drawings (continued)

Drawing No.	Title
1364-93053	HR-1 & HR-2 Typical Details
1364-93054	Cable Tray Fire Break Details
1364-93071	Penetration Seal Typicals MS-1, MS-2, MS-3, & MS-4
1364-93072	Penetration Seal Typicals MS-5 & MS-6
1364-95001 through 1364-95999	Typical Fire Wrap Details
2166-B-420	MFDIC I/O Report
CWD 2166-8-401	

Sheet No.	Title
2581	Motor Driven Fire Pump 1-4B-NNS
2582	Jockey Fire Pump 1-4X-NNS
2583	Diesel-Driven Fire Pump 1-4-NNS
2587	Fire Protection Water Supply Valve 8FQ-W102-1
2588	Valves 2FP-V44SA-1 & 2FP-V45SA-1
9501	Fire Detection System LFDCP-15 Sh. 1
9502	Fire Detection System LFDCP-15 Sh. 2
9503	Fire Detection System LFDCP-15 Sh. 3
9504	Fire Detection System LFDCP-15 Sh. 4
9505	Fire Detection System LFDCP-15 Sh. 5
9506	Fire Detection System LFDCP-15 Sh. 6
9507	Fire Detection System LFDCP-15 Sh. 7
9508	Fire Detection System LFDCP-15 Sh. 8
9509	Fire Detection System LFDCP-15 Sh. 9
9510	Fire Detection System LFDCP-15 Sh. 10
9511	Fire Detection System LFDCP-15 Sh. 11
9512	Fire Detection System LFDCP-15 Sh. 12

8.1 Drawings (continued)

Sheet No.	Title
9513	Fire Detection System LFDCP-15 Sh. 13
9514	Fire Detection System LFDCP-15 Sh. 14
9515	Fire Detection System WPB-Cable Spread Area LGP-2
9517	Main Fire Detection Control Panel Sh. 1
9518	Main Fire Detection Information Center Sh. 2
9519	Main Fire Detection Information Center Sh. 3
9526	Fire Detection System LFDCP-1 Sh. 1
9527	Fire Detection System LFDCP-1 Sh. 2
9528	Fire Detection System LFDCP-1 Sh. 3
9529	Fire Detection System LFDCP-1 Sh. 4
9530	Fire Detection System LFDCP-1 Sh. 5
9531	Fire Detection System LFDCP-1 Sh. 6
9533	Fire Detection System LFDCP-2 Sh. 1
9534	Fire Detection System LFDCP-2 Sh. 2
9535	Fire Detection System LFDCP-2 Sh. 3
9538	Fire Detection System LFDCP-3 Sh. 1
9539	Fire Detection System LFDCP-3 Sh. 2
9540	Fire Detection System LFDCP-3 Sh. 3
9542	Fire Detection System LFDCP-4 Sh. 1
9543	Fire Detection System LFDCP-4 Sh. 2
9544	Fire Detection System LFDCP-4 Sh. 3
9545	Fire Detection System LFDCP-4 Sh. 4
9546	Fire Detection System LFDCP-4 Sh. 4
9547	Fire Detection System LFDCP-4 Sh. 5
9548	Fire Detection System LFDCP-4 Sh. 7

8.1 Drawings (continued)

Sheet No.	Title
9549	Fire Detection System LFDCP-4 Sh. 8
9550	Fire Detection System LFDCP-5 Sh. 1
9551	Fire Detection System LFDCP-5 Sh. 2
9552	Fire Detection System LFDCP-5 Sh. 3
9553	Fire Detection System LFDCP-5 Sh. 4
9554	Fire Detection System LFDCP-5 Sh. 5
9555	Fire Detection System LFDCP-7 Sh. 7
9556	Fire Detection System LGP-3
9557	Fire Detection System LFDCP-6 Sh. 1
9558	Fire Detection System LFDCP-6 Sh. 2
9559	Fire Detection System LFDCP-6 Sh. 3
9560	Fire Detection System LFDCP-6 Sh. 4
9561	Fire Detection System RAB-Cable Spread Area LGP-1 Sh. 1
9562	Fire Detection System RAB-Cable Spread Area LGP-1 Sh. 2
9563	Fire Detection System LFDCP-7 Sh. 1
9564	Fire Detection System LFDCP-7 Sh. 2
9565	Fire Detection System LFDCP-7 Sh. 3
9566	Fire Detection System LFDCP-7 Sh. 4
9567	Fire Detection System LFDCP-7 Sh. 5
9568	Fire Detection System LFDCP-7 Sh. 6
9569	Fire Detection System LFDCP-8 Sh. 1
9570	Fire Detection System LFDCP-8 Sh. 2
9571	Fire Detection System LFDCP-8 Sh. 3
9573	Fire Detection System LFDCP-9 Sh. 1
9574	Fire Detection System LFDCP-9 Sh. 2

8.1 Drawings (continued)

Sheet No.	Title
9575	Fire Detection System LFDCP-9 Sh. 3
9576	Fire Detection System LFDCP-9 Sh. 4
9577	Fire Detection System LFDCP-9 Sh. 5
9578	Fire Detection System LFDCP-9 Sh. 6
9579	Fire Detection System LFDCP-9 Sh. 7
9580	Fire Detection System LFDCP-9 Sh. 8
9581	Fire Detection System LFDCP-9 Sh. 9
9582	Fire Detection System LFDCP-9 Sh. 10
9583	Fire Detection System LFDCP-9 Sh. 11
9584	Fire Detection System LFDCP-9 Sh. 12
9585	Fire Detection System LFDCP-9 Sh. 13
9586	Fire Detection System LFDCP-9 Sh. 14
9588	Fire Detection System LFDCP-10 Sh. 1
9589	Fire Detection System LFDCP-10 Sh. 2
9590	Fire Detection System LFDCP-10 Sh. 3
9591	Fire Detection System LFDCP-10 Sh. 4
9593	Fire Detection System LFDCP-11 Sh. 1
9594	Fire Detection System LFDCP-11 Sh. 2
9595	Fire Detection System LFDCP-11 Sh. 3
9596	Fire Detection System LFDCP-11 Sh. 4
9597	Fire Detection System LFDCP-11 Sh. 5
9598	Fire Detection System LFDCP-11 Sh. 6
9599	Fire Detection System LFDCP-7 Sh. 9
9601	Fire Detection System LFDCP-12 Sh. 1
9602	Fire Detection System LFDCP-12 Sh. 2
9603	Fire Detection System LFDCP-12 Sh. 3

8.1 Drawings (continued)

Sheet No.	Title
9604	Fire Detection System LFDCP-12, Sh. 4
9605	Fire Detection System LFDCP-12 Sh. 5
9606	Fire Detection System LFDCP-12 Sh. 6
9607	Fire Detection System LFDCP-12 Sh. 7
9610	Fire Detection System LFDCP-13 Sh. 1
9611	Fire Detection System LFDCP-13 Sh. 2
9612	Fire Detection System LFDCP-13 Sh. 3
9613	Fire Detection System LFDCP-13 Sh. 4
9614	Fire Detection System LFDCP-13 Sh. 5
9615	Fire Detection System LFDCP-13 Sh. 6
9616	Fire Detection System LFDCP-13 Sh. 7
9617	Fire Detection System LFDCP-13 Sh. 8
9618	Fire Detection System LFDCP-13 Sh. 9
9621	Fire Detection System LFDCP-14 Sh. 1
9622	Fire Detection System LFDCP-14 Sh. 2
9623	Fire Detection System LFDCP-14 Sh. 3
9624	Fire Detection System LFDCP-14 Sh. 4
9625	Fire Detection System LFDCP-14 Sh. 5
9626	Fire Detection System LFDCP-14 Sh. 6
9627	Fire Detection System LFDCP-14 Sh. 7
9628	Fire Detection System LFDCP-14 Sh. 8
9629	Fire Detection System LFDCP-14 Sh. 9
9630	Fire Detection System LFDCP-14 Sh. 10
9631	Fire Detection System LFDCP-14 Sh. 11
9632	Fire Detection System LFDCP-14 Sh. 12

8.1 Drawings (continued)

Sheet No.	Title
9635	Fire Detection System LFDCP-6 Sh. 5
9638	Fire Detection System LFDCP-7 Sh. 8
9641	Fire Detection System LFDCP-17 Sh. 1
9642	Fire Detection System LFDCP-17 Sh. 2
9651	Fire Detection System LFDCP-16 Sh. 1
9652	Fire Detection System LFDCP-16 Sh. 2
9653	Fire Detection System LFDCP-16 Sh. 3
9654	Fire Detection System LFDCP-16 Sh. 4
9655	Fire Detection System LFDCP-16 Sh. 5
9656	Fire Detection System LFDCP-16 Sh. 6
9657	Fire Detection System LFDCP-16 Sh. 7
9658	Fire Detection System LFDCP-16 Sh. 8
9659	Fire Detection System LFDCP-16 Sh. 9
9660	Fire Detection System LFDCP-16 Sh. 10
9661	Fire Detection System LFDCP-16 Sh. 11
9662	Fire Detection System LFDCP-16 Sh. 12
9663	Fire Detection System LFDCP-16 Sh. 13
9664	Fire Detection System LFDCP-16 Sh. 14
9665	Fire Detection System LFDCP-16 Sh. 15
9666	Fire Detection System LFDCP-16 Sh. 16
9667	Fire Detection System WPB Appendix R Elev. 1
9668	Fire Detection System WPB Appendix R Elev. 2
9669	Fire Detection System WPB Appendix R Elev. 5
9670	Fire Detection System FHB Appendix R Elev. 9
9671	Fire Detection System Cont. Appendix R Elev. K

8.2 Specifications

8.2.1 EBASCO Specifications

Specification No.	Title
BE-09	Fixed Automatic Water Extinguishment Systems
IN-24	Fire Detection System
M-62	Fire Hose & Access NNS Equip. (Fire Protection Equipment)
M-20	Fire Water Pump
AS-15	Doors, Frames, Hardware, and Saddles
AS-54	Fire & Control Doors & Hardware
AS-60	Penetration Barriers & Fire-Stop Assemblies
BE-04A	HVAC Main Plant Fabrication and Installation
BE-32	Smoke Exhaust Fans
E-28	Containment Electrical Penetration
IN-11	Rotameters & Flow Switches
M-30	General Power Piping
M-32A	High-Pressure Alloy & Carbon Steel Valves Nuclear Safety
M-32P	High-Pressure Alloy & Carbon Steel Valves
M-33P	Medium & Low-Pressure Alloy & Carbon Steel Valves
M-35	Cast Iron & Bronze Valves
M-54	Nuclear Containment, Mechanical Penetrations, Components & Assembly
M-61	Fire Hydrant, Post Indicator Valves & Curb Box Valves
M-49M	Strainers

8.2.2 National Fire Protection Association (NFPA)

Std. No. 6 - Industrial Fire Loss Prevention

Std. No. 10 - Installation of Portable Fire Extinguishers

Std. No. 11 - Foam Extinguishing Systems

Std. No. 13 - Installation of Sprinkler System

8.2.2 National Fire Protection Association (NFPA) (continued)

Std. No. 14 - Standpipe and Hose Systems

Std. No. 15 - Water Spray Fixed Systems

Std. No. 20 - Centrifugal Fire Pumps

Std. No. 24 - Outside Protection

Std. No. 26 - Supervision of Valves

Std. No. 30 - Flammable and Combustible Liquids Code

Std. No. 51B - Cutting and Welding Process

Std. No. 70 - National Electric Code

Std. No. 72A - Local Protective Signaling Systems

Std. No. 72D - Proprietary Protective Signaling Systems

Std. No. 72E - Automatic Fire Detectors

Std. No. 80 - Fire Doors and Windows

Std. No. 90 - Air Conditioning and Ventilation Systems

Std. No. 101 - Life Safety Code

Std. No. 194 - Screw Threads and Gaskets for Fire Hose Couplings

Std. No. 196 - Fire Hose

Std. No. 198 - Fire Hose, Care of

Std. No. 251 - Fire Tests, Building Construction and Materials

Std. No. 291 - Fire Hydrants, Uniform Markings

Std. No. 803 - Fire Protection, Nuclear Power Plants

8.3 Technical Manual

Equipment	Manufacturer	Manual No.
Motor Driven Fire Pump Motor	General Electric	IJX
Diesel Fire Pump Engine	Cummins Diesel Engines	MJD
Jockey Fire Pump Motor	U.S. Electrical Motors	IKA
Fire Pumps	Johnson Pump	EIZ

8.3 Technical Manual (continued)

Diesel Fire Pump Angle Gear	Randolph	UJL
Fire Detection System	Johnson Yokogawa Corp.	TDL
Fire Detection & Annunciation	Keltron Corp.	NCY

8.4 Miscellaneous

1. Nuclear Mutual Limited (NML) - Property Loss Prevention Standards for Nuclear Generating Stations

2. Underwriters' Laboratory, Inc. (UL) Fire Protection Equipment List

3. United States Nuclear Regulatory Commission

   SRP (Standard Review Plan) Section 9.5.1, "Fire Protection Program"

   10CFR50 Appendix A, General Design Criterion 3, "Fire Protection"

   10CFR50 Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components"

   Branch Technical Position APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants"

   Appendix A to Branch Technical Position APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976"

   Branch Technical Position CMEB 9.5-1, (Nureg 0800) "Guidelines for Fire Protection for Nuclear Power Plants" (formerly BTP ASB 9.5-1)

   Regulatory Guide 1.88, Rev. 2, "Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records"

   Appendix R to Branch Technical Position APCSB 9.5-1

4. American National Standards Institute (ANSI)

   B 31.1 - Power Piping

   N45.2.9 - Quality Assurance Records, Protection from Fire Hazards

5. American Society for Testing Materials (ASTM)

   E-136 - Cable Tray Construction

6. Factory Mutual Research (FM) Fire Protection Equipment Approval Guide.

7. Institute of Electrical and Electronic Engineers (IEEE) Std. 383-74 IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

8.4 Miscellaneous (continued)

POM Vol. 3 FP-Minimum Requirements and Mitigating Action Part 8 FPP-013

POM Vol. 3 FP-Surveillance Requirements Part 8 FPP-014

Revision Summary

Rev. 8:
Page 53 - Added references to drawings 2167-S-153 per ESR 95-00715. Also added references to 2167-S-152 S01 and 2167-S-152 S02, which were created per PCR -1103.

Rev. 9: Per ESR 95-00431
Page 33 - Deleted reference to thermal detectors for Zone 1-104 and 1-112.
Page 34 - First sentence. Deleted reference to Zone 1-104 and 1-112.

Rev. 10:
Page 5: - Corrected Typo
Page 6: - Deleted reference to different hose adapters per RAF 2076.
Page 7: - Referenced correct Fire Pump Model - Typo.
Corrected a dash instead of a slash - Typo.
Page 19: - Corrected the fire pump capacity amount - Typo.
Page 33: - Added zone 1-187 per ESR 95-00995.
Page 36: - Removed the reference to the make-up to a chiller in the RAB as per PCR-5534.
Page 53: - Added drawing for RAB elev. 286 per ESR 95-00715.
Page 65: - Referenced correct Vendor Manuals for the different components - Typo.
Added Vendor Manual reference for the fire pumps.
Page 66: - Referenced correct Vendor Manual for the Diesel Angle Drive - Typo.
Added reference to the BTP CMEB as per NUREG 0800.

Rev.11:
Page 14 - Per ESR No. 96-00511, revised wording of Section 4.3.0.1.h to include MCR annunciation.
Page 15 - Per ESR No. 96-00511, revised wording of Section 4.3.2.b to accurately describe system operation following implementation of the modification.
Page 36 - Per ESR No. 96-00511, revised wording of Sections 5.1.3 and 5.1.4 to properly describe power feeds to the MFDIC equipment.
Page 37 - Per ESR No. 96-00511, corrected power feed reference document for LFDCP-16-1.
Page 38 - Per ESR No. 96-00511, revised "Fire Panel and Location" descriptions for MFDIC CCU, Display Console PC and Hard-Wired Annunciator.
Page 58 - Per ESR No. 96-00511, added MFDIC I/O Report drawing as a reference.
Page 66 - Per ESR No. 96-00511, added VM-TDL and VM-NCY as references.

Rev. 12:
Page 26 - Corrected I-189 to read 1-189 - Typo
Page 61 - Per CR 99-01371, added Sheet 9599
Page 62 - Corrected Sheet 9604 Description to read LFDCP-12 Sheet 4 instead of LFDCP-4.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

CPL-2165-S-0555, REV. 15:

SIMPLIFIED FLOW DIAGRAM FIRE PROTECTION SYSTEM SHEET 1 UNIT 1

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER:

CPL-2165-S-0555, REV. 15:

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CPL-2165 S-0556, REV. 13:

SIMPLIFIED FLOW DIAGRAM FIRE PROTECTION SYSTEM SHEET 2 UNIT 1

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CPL-2165 S-0556, REV. 13:

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D-7A

I

INFORMATION USE

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description

NUMBER: SD-158

TITLE: Plant Lighting

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1.0 SYSTEM PURPOSE

The purpose of the plant's lighting system is to provide adequate illumination throughout the plant during normal and emergency operating conditions. The system supplies, at minimum, enough illumination for personnel to monitor, operate, and repair equipment without trouble. It also permits the personnel to move safely through essential areas. The system includes a normal AC lighting system, a normal/emergency (N/E) AC lighting system, and an emergency DC lighting system. Therefore, adequate illumination will be available under any condition.

2.0 SYSTEM FUNCTION

CAUTION

Setpoints given in this SD are for reference only. Actual values should be obtained from a controlled setpoint document.

2.1 Normal AC Lighting System

The Normal AC Lighting System provides illumination for the plant when in a normal operating mode or when offsite power is available. A normal operating mode includes plant start-up with offsite power available, plant running with unit auxiliary power, or plant hot or cold shutdown with offsite power available. The system is energized continuously from nonsafety-related 480 volt motor control centers (MCCs) through dry type transformers (Figure 7.2). These transformers, in turn, supply power to local area lighting panels (see Figure 7.1). In all, this system provides approximately 80% of total plant illumination.

2.2 Normal/Emergency (N/E) AC Lighting System

The Normal/Emergency (N/E) AC Lighting System is a non-Class 1E, nonseismic category 1 system and is available under all plant conditions. The system provides illumination for all plant areas, except for the Turbine Building Elevation 314, the Reactor Auxiliary Building Elevation 305, and the Yard Area (see Table 6.1). The Yard Area is serviced by security lighting. The system loads are divided among safety Divisions A and B (referred to as trains). Either train can supply sufficient lighting necessary for safe and orderly operation of the plant during any mode of emergency operation. The system is energized continuously from Divisions A and B safety-related 480 volt MCCs through dry type transformers. These transformers in turn feed the N/E local area lighting panels (see Figure 7.1). In the instance of offsite power failure, emergency diesel generators provide the source of power needed for each train. The N/E AC Lighting System provides the remaining 20% of total plant illumination.

2.3 Emergency DC Lighting System

When there is a loss of the N/E System, the Emergency DC Lighting System provides light for several areas, including the Main Control Room, Auxiliary Control Panel, and the Computer Room. The Emergency DC Lighting System, which is non-Class 1E and nonseismic category 1, is powered from the 125V battery Station 1A upon loss of either safety train A or B (Figure 7.3). Energization is maintained only until the diesels reach rated speed and voltage and the 480 volt safety train MCCs are reenergized. The time required for the diesels to do this is approximately 10 seconds. In balance of plant areas, DC emergency lighting is provided by self-contained storage battery lighting fixture assemblies. DC emergency lighting is provided through battery pack (8-hour rating) for access and egress routes to and from all fire areas and in areas that must be manned for Safe Shutdown as determined by operations, fire protection and electrical disciplines(Figure 7.4). Areas not required for operation or monitoring of Safe Shutdown equipment and do not provide an access/egress route to Safe Shutdown equipment but require emergency lighting for Life Safety reasons only, may be provided with local DC emergency battery pack lighting which will provide illumination for a minimum of 1 ½ hours (Figure 7.5).

3.0 COMPONENTS

3.1 Transformers

The dry-type transformers are 3 phase (3Ø), 4 wire (4W), 60 Hz, 480 delta primary to 208Y/120V (or 480Y/277V) secondary. The ratings range between 15 KVA and 45 KVA.

3.2 Lighting Panels

Lighting panels used for plant lighting consist of both indoor and outdoor panels.

Indoor panels are designed to operate with a maximum indoor ambient temperature of 104°F under a relative humidity of 85 percent.

Outdoor panels are NEMA 3R rainproof and sleet resistant construction. Doors have gaskets, rustproof hinges, windstop for 120° openings, and a one inch bottom skirt. The top overhangs the front of the panel and slopes downward front to back. The outdoor panels operate with a maximum outdoor ambient temperature of 103-105°F under 85 percent relative humidity.

3.3 125V Battery Station 1A

The Emergency DC Battery Station 1A is charged to 125V. (SD-156).

3.4 Illumination Devices

Illumination devices enable proper lighting of all spaces. Mercury-containing illumination sources are normally prohibited in the vicinity of systems that could return mercury contamination to the primary system. Mercury is highly corrosive to stainless steel, inconel, and copper containing alloys. It becomes activated in a neutron flux and creates a health hazard as a vapor. Fluorescent, mercury, metal-halide, and high pressure sodium lamps all contain small amounts of mercury. Two mercury containing light fixtures have been evaluated and approved for temporary use in the containment building and fuel handling building (i.e., during outages). Light fixture CP&L P/N 706-087-08 was evaluated by ESR No. 97-00218 and light fixture CP&L P/N 740-053-98 was evaluated by ESR No. 99-00324. In addition to these two fixtures, incandescent sources are also used in areas where mercury contamination could occur.

4.0 OPERATION

CAUTION

Setpoints given in this SD are for information only. Actual values should be obtained from a controlled Setpoint Document.

4.1 Normal Operation

The control of the plant's lighting system is accomplished through the use of circuit breakers, switches, photocells, and relays. Circuit breakers and switches are the most commonly used devices to operate plant lighting, with photocells controlling outdoor lights. The emergency lighting is operated by means of relays.

Containment lighting panels LP 101-107 receive power through relay junction boxes located in the Reactor Auxiliary Building electrical penetration areas A and B. The junction boxes are operated from one switch located near the personnel air lock in the Reactor Auxiliary Building. The relay junction boxes provide control of all Containment lighting by one switch outside of Containment.

4.2 Limiting Conditions for Operation

No Technical Specifications apply to this system.

5.0 INTERFACE SYSTEMS

5.1 System Required for Support

The system required for support of the Lighting System is the Electrical Distribution System (SD-156).

5.2 System-to-System Cross Ties

There are no system-to-system cross ties.

6.0 Tables

6.1 Plant Lighting Sources

Table 6.1

PLANT LIGHTING SOURCES

Building	Elevation	Normal AC Lighting	Normal/Emergency AC Lighting	Emergency DC Lighting
1 - Containment	221	Yes	Yes	No
	236	Yes	Yes	No
	261	Yes	Yes	No
	286	Yes	Yes	No
2 - Reactor Aux	190	Yes	Yes	Yes
	216	Yes	Yes	Yes
	236	Yes	Yes	Yes
	261	Yes	Yes	Yes
	286	Yes	Yes	Yes
	305	Yes	No	Yes
(Main Control Room and Computer Room)	305	Yes	Yes	Yes
3 - Fuel Handling	216	Yes	Yes	Yes
	236	Yes	Yes	Yes
	261	Yes	Yes	Yes
	286	Yes	Yes	Yes
	305	Yes	Yes	Yes
	324	Yes	Yes	Yes
4 - Waste Processing	211	Yes	Yes	Yes
	236	Yes	Yes	Yes
	261	Yes	Yes	Yes
	276	Yes	Yes	Yes
	291	Yes	Yes	Yes
5 - Turbine Generator Area	240	Yes	Yes	Yes
	261	Yes	Yes	Yes
	286	Yes	Yes	Yes
	314	Yes	No	No
6 - Yard Lighting	---	Yes	No	No
7 - Personnel Air Lock	236	No	No	Yes
	261	No	No	Yes

7.0 Figures

7.1 Lighting Distribution Panel

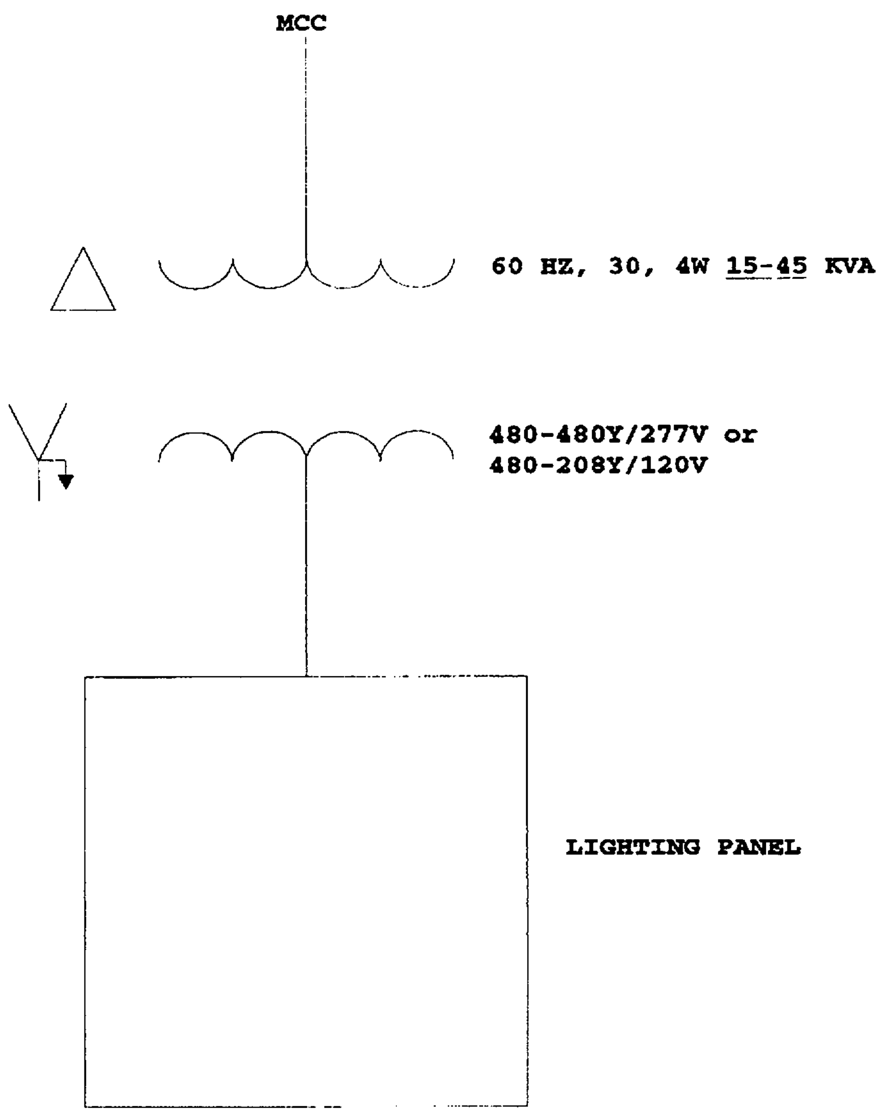
7.2 Typical Lighting Transformer

7.3 Simplified Emergency Lighting Control

7.4 Typical 8-hour Battery Emergency Unit

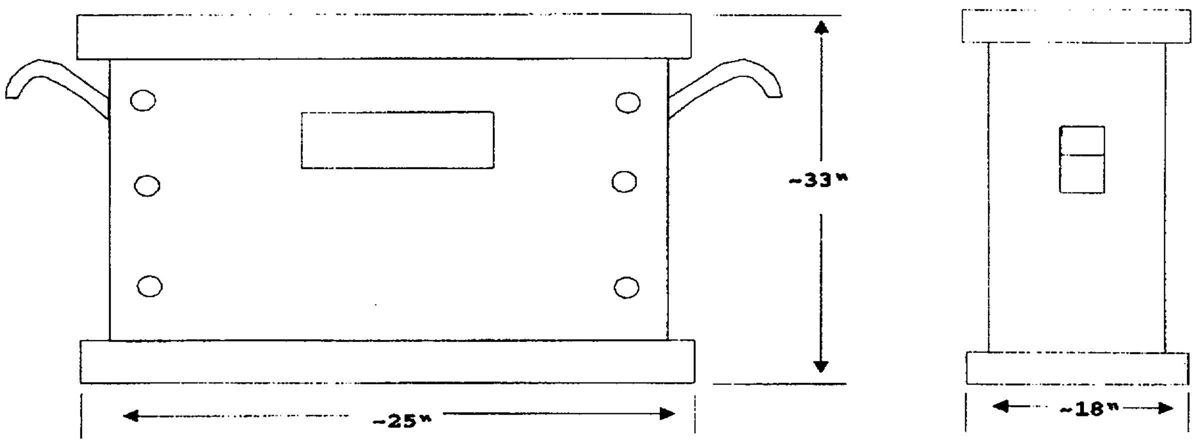
7.5 Typical 1 ½-hour Battery Emergency Unit

SD 158
LIGHTING DISTRIBUTION PANEL
Figure 7.1



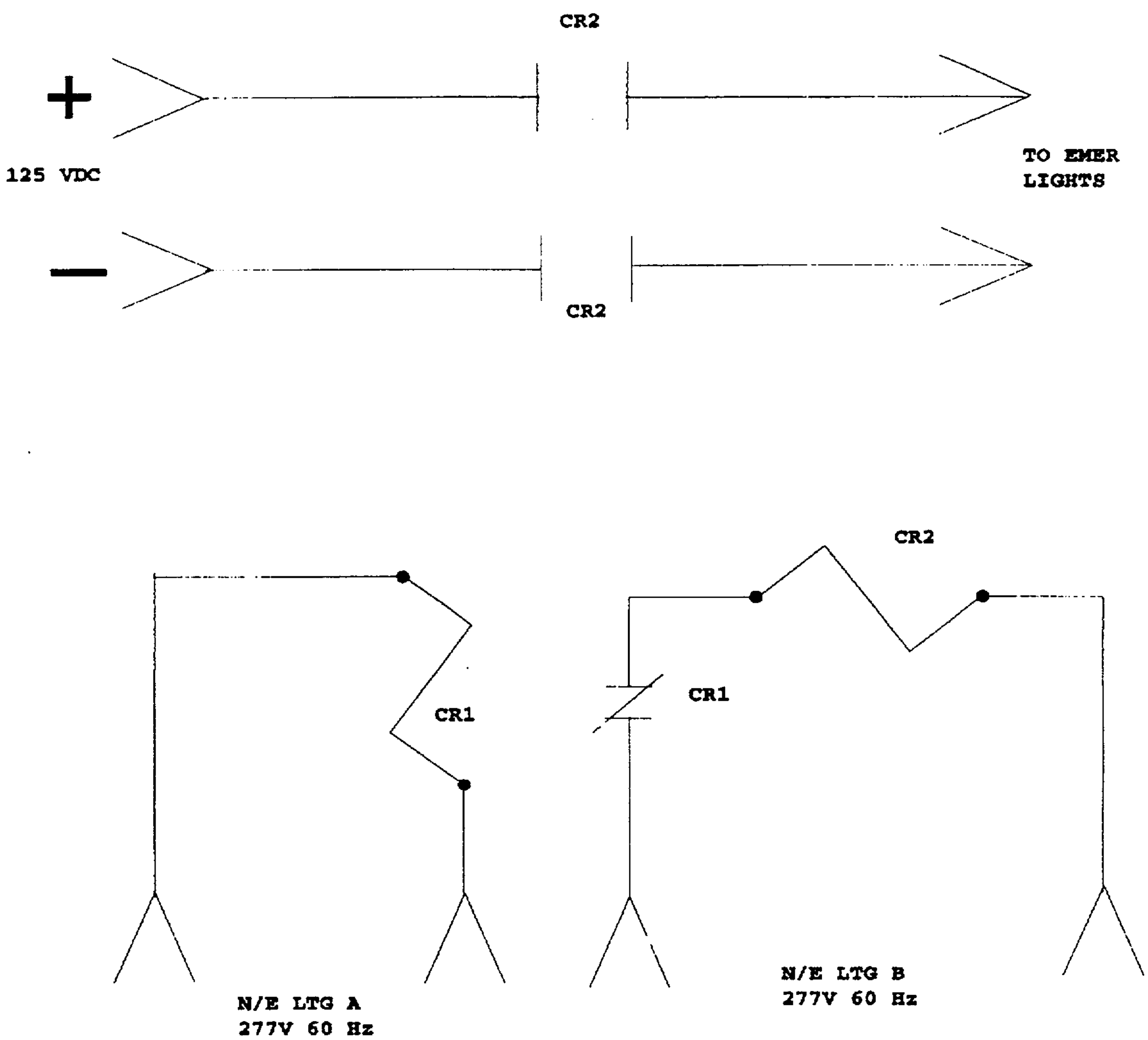
TYPICAL ONE LINE DIAGRAM FOR
NORMAL AC LIGHTING
OR
NORMAL/EMERGENCY AC LIGHTING

SD 158
TYPICAL LIGHTING TRANSFORMER
FIGURE 7.2



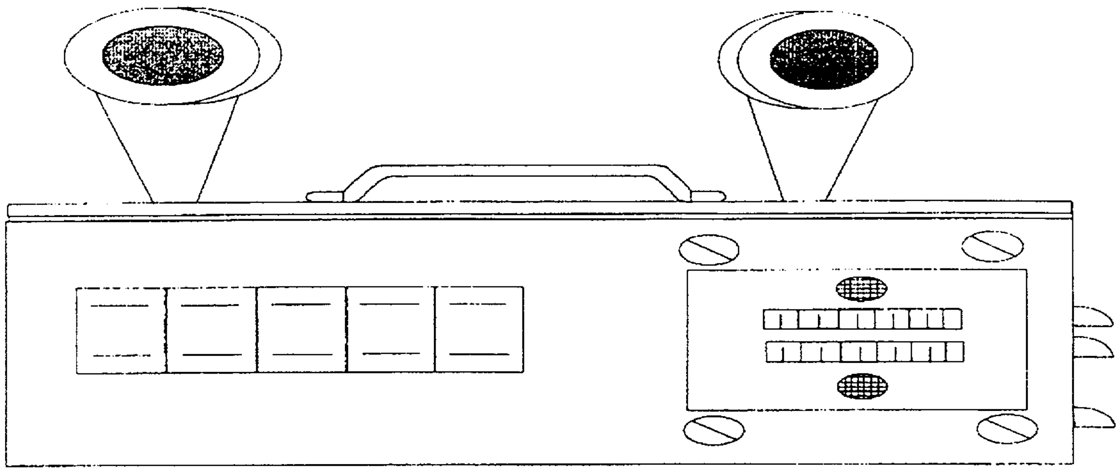
FLOOR, WALL, OR CEILING MOUNTED

SD 158
SIMPLIFIED EMERGENCY
LIGHTING CONTROL
Figure 7.3

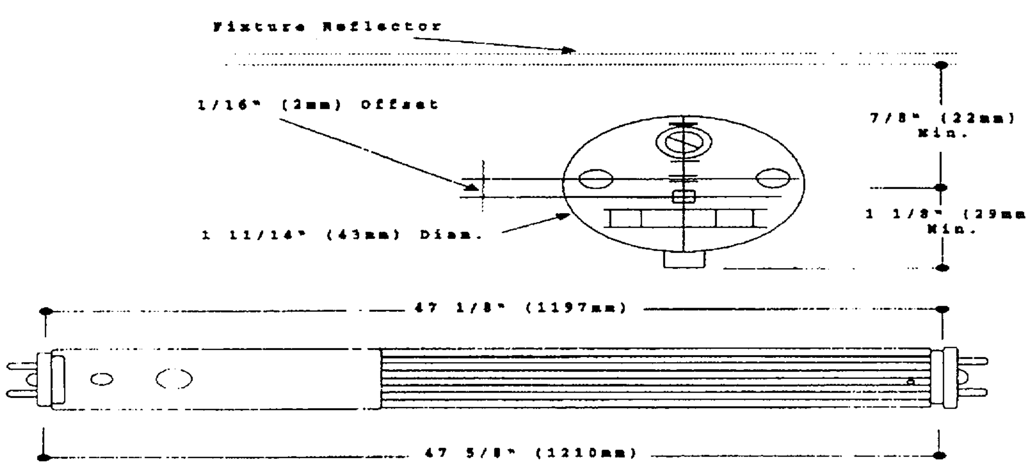


(ALL CONTACTS SHOWN WITH N/E LTG A, B ENERGIZED)

SD 158
TYPICAL BATTERY EMERGENCY UNIT
Figure 7.4



SD-158
TYPICAL 1 ½ -HOUR BATTERY EMERGENCY UNIT
Figure 7.5



8.0 References

8.1 *Site Lighting Drawings*

Drawing No.	Title
CAR-2166-G0052	Station Yard Lighting
CAR-2166-G093	Diesel Generator Building Lighting
CAR-1266-G094	Diesel Fuel Oil Storage Tank Area Conduit, Grounding, Lighting
CAR-2166-G124S01	Fuel Handling Building Lighting EL 305.00 feet
CAR-2166-G124S02	Fuel Handling Building Lighting EL 324.00 feet
CAR-2166-G138	Fuel Handling Building Lighting EL 216.00 feet Sh. #1
CAR-2166-G139	Fuel Handling Building Lighting EL 216.00 feet Sh. #2
CAR-2166-G140	Fuel Handling Building Lighting EL 236.00 feet Sh. #1
CAR-2166 G141	Fuel Handling Building Lighting EL 236.00 feet Sh. #2
CAR-2166-G142	Fuel Handling Building Lighting EL 261.00 feet Sh. #1
CAR-2166-G143	Fuel Handling Building Lighting EL 261.00 feet Sh. #2
CAR-2166-G144	Fuel Handling Building Lighting EL 286.00 feet Sh. #1
CAR-2166-G145	Fuel Handling Building Lighting EL 286.00 feet Sh. #2
CAR-2166-G165	Waste Processing Building Lighting EL 211.00 feet
CAR-2166-G166S01	Waste Processing Building Lighting EL 236.00 feet Unit 1
CAR-2166-G166S02	Waste Processing Building Control Room
CAR-2166-G167	Waste Processing Building Lighting EL 261.00 feet Unit 1
CAR-2166-G168	Waste Processing Building Lighting EL 276.00 feet Unit 1
CAR-2166-G169	Waste Processing Building Lighting EL 291.00 feet Unit 1
CAR-2166-G191	Turbine Generator Area Ground Floor
CAR-2166-G192	Turbine Generator Area Mezz. Floor Lighting EL 286.00 feet Unit 1
CAR-2166-G193	Turbine Generator Area 0 Per. Floor Lighting EL 314.00 feet Unit 1
CAR-2166-G194	Turbine Generator Area Lighting EL 240.00 feet

8.1 *Site Lighting Drawings (continued)*

Drawing No.	Title
CAR-2166-G201	Containment Building Lighting El. 221.00 feet Unit 1
CAR-2166-G202	Containment Building Lighting EL 236.00 feet Unit 1
CAR-2166-G203	Containment Building Lighting EL 261.00 feet Unit 1
CAR-2166-G204	Containment Building Lighting EL 286.00 feet Unit 1
CAR-2166-G211	Decontainment Area Lighting EL 261.00 feet
CAR-2166-G328S01	Control Room Area Lighting Units 1 & 2 Sh. #1
CAR-2166-G328S02	Control Room Area Lighting Units 1 & 2 Sh. #2
CAR-2166-G328S04	Reactor Auxiliary Building Lighting EL 305.00 feet Sh. #4 Units 1 & 2
CAR-2166-G334	Reactor Auxiliary Building Lighting EL 190.00 feet Units 1 & 2
CAR-2166-G335	Reactor Auxiliary Building Lighting EL 216.00 Sh. #1 Units 1 & 2
CAR-2166-G336	Reactor Auxiliary Building Lighting EL 216.00 feet Sh. #2 Units 1 & 2
CAR-2166-G337	Reactor Auxiliary Building Lighting EL 236.00 feet Sh. #1 Units 1 & 2
CAR-2166-G338	Reactor Auxiliary Building Lighting EL 236.00 feet Sh. #2 Units 1 & 2
CAR-2166-G341	Reactor Auxiliary Building Lighting EL 261.00 feet Sh. #1 Units 1 & 2
CAR-2166-G342	Reactor Auxiliary Building Lighting EL 261.00 feet Sh. #2 Units 1 & 2
CAR-2166-G345	Reactor Auxiliary Building Lighting EL 286.00 feet Sh. #1 Units 1 & 2
CAR-2166-G346	Reactor Auxiliary Building Lighting EL 286.00 feet Sh. #2 Units 1 & 2
CAR-2166-G607	Cooling Tower Intake Structure Lighting Unit 1
CAR-2166-G553	Emergency Service Waste Intake Structure Area Lighting
CAR-2166-G660	Water Treatment Building Lighting
CAR-2166-A046	Lighting Details and Notes
CAR-2166-B047	Lighting Panel Details

8.2 Specifications

Specifications No.	Name
Ebasco 212-77	Lighting and Appliance Branch - Circuit Panelboards
Ebasco 212-77 Ta	Lighting and Miscellaneous Panel Specifications

8.3 Technical Manuals

Lighting and Miscellaneous Transformers P.O. #073 File #16-9224

Lighting and Miscellaneous Panels P.O. #074 File #16-2505

8.4 Other References

Ebasco Lighting Bill of Materials

Ebasco Lighting & Miscellaneous Transformers Supplement No. 3

FSAR 9.5.3 Lighting System, Volume 17

SUMMARY OF CHANGES

Rev. 5 Summary

Page 2 Added Figure 7.5 to Table of Contents

Page 4 Revised Section 2.3 to incorporate the new Life Safety emergency lighting per ESR 9800040 R/0 (page 5.22).

Page 7 Added new Figure 7.5 to incorporate new 1 ½-hour battery emergency light per ESR 9800040 R/0 (page 5.23).

Page 11 Added new Figure 7.5 to incorporate new 1 ½-hour battery emergency light per ESR 9800040 R/O (page 5.24).

Rev. 6 Summary

Page 4 Revised wording of Section 3.4 to clarify the use of approved mercury containing light fixtures in the containment building and the fuel handling building on a temporary basis per ESR No. 99-00324 R/0.

R
REFERENCE USE

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 3

PART 2

PROCEDURE TYPE: Operating Procedure

NUMBER: OP-116

TITLE: Fuel Pool Cooling and Cleanup

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1.0 PURPOSE

This procedure provides operating instructions for the following:

- Starting up and shutting down the FP Cooling and Cleanup System
- Filling and venting the Fuel Pool Cooling and Cleanup System
- Making up to the Fuel Pools, Transfer Canals and Cask Loading Pool
- Purification of the RWST, Refueling Cavity, Transfer canals, Cask Loading Pool and Fuel Pools
- Draining the Refueling Cavity, Cask Loading Pool and Transfer Canals to the RWST or RHT
- Skimmer operation for all pools
- Changing resins in the Fuel Pool Demineralizer
- Emergency Makeup from ESW.

2.0 REFERENCES

2.1 Plant Operating Manual Procedures

1. PLP 702
2. OMM-001
3. OP-102
4. OP-112
5. OP-120.02.39
6. OP-120.04
7. OP-120.06.01
8. OP-120.08
9. OP-143.03
10. OP-145
11. OP-151.01
12. OP-156.02
13. GP-009
14. MMM-011
15. CM-M0118
16. SD-116
17. HPP-800

2.2 Technical Specifications

1. 3.1.2.5
2. 3.1.2.6
3. 3.5.4
4. 5.6.2
5. 3.9.1
6. 3.9.10
7. 3.9.11

2.3 Final Safety Analysis Report

1. 9.1.3

2.4 Drawings

1. 5-S-0547
2. 5-S-0549 S02
3. 5-S-0550
4. 5-S-0561
5. 5-S-0562
6. 5-S-0805
7. 5-S-0807
8. 5-S-1311
9. 5-S-1312
10. 5-S-1347

2.5 Technical Manuals

1. VM-BAM, Strainers, Basket, Zurn
2. VM-BHQ, Pumps
3. VM-MXJ, Heat Exchangers, Yuba
4. VM-MXK, Demineralizer, Hungerford & Terry

2.6 Corrective Action Program (CAP) Items

1. 86H0404

2.7 Other

1. Justification for Continued Operation (JCO) 96-001
2. ESR 97-00272

3.0 PREREQUISITES

1. The Component Cooling Water System is in operation per OP-145 as needed for this procedure.
2. Electrical power is available per OP-156.02 as needed for this procedure.
3. RWST level and boron concentration are per applicable Technical Specifications, as needed for this procedure.
4. The Filter Backwash System is operable per OP-120.02.39 as needed for this procedure.
5. The Demineralized Water System is in operation per OP-143.03 as needed for this procedure.
6. The Waste Holdup & Evaporation System is in operation per OP-120.06.01 as needed for this procedure.
7. Compressed Air is available per OP-151.01 as needed for this procedure.

4.0 PRECAUTIONS AND LIMITATIONS

1. Fuel Pool Cooling Pumps will trip on an Emergency Sequencer signal and must be manually restarted.

2. The Fuel Pool Pump Room Fans, AH-17-1-4A(B) are Emergency Sequencer Load Block 9 loads and should be manually restarted after a Sequencer actuation, to maintain area temperatures.

3. The Fuel Pool Cooling Pump Strainers should be cleaned when PDS-5130 AS (BS) reaches 10 psid, or Fuel Pools Cooling Pump 1-4A/1-4B STRNR DIFF PRESS HI alarm is received on panel 3SF-SFPC7 (ALB-23/5-15 Fuel Pool PNL FP-7 TRBL alarm will also come in).

4. The Fuel Pool level should be monitored closely on Skimmer System startup, to ensure proper lineup and prevent lowering Fuel Pool level below the Tech Spec limit.

5. The Fuel Pools Leak Detection System should be monitored if leakage is suspected.

6. The Fuel Pool Skimmer Pump Suction Strainer should be cleaned when FP SKIMMER PP 1 & 4X SUCT STNR DIFF PRESS HI alarm is received on panel 3SF-SFPC9. (ALB-23/5-14 FUEL POOL PNL FP-9 TRBL alarm will also come in.)

7. To protect the Fuel Pool Skimmer Pump, the following parameters must be maintained:

   - Total Fuel Pool Skimmer Pump flow must remain less than 385 gpm to prevent pump run out. To accomplish this, discharge pressure must be maintained greater than or equal to 110 psig.

   - To maintain minimum suction path, a minimum of 4 skimmers must be in service

8. When draining or venting, ensure radiological controls are maintained.

9. Line up only one train of SFP Purification to the SFP Demineralizer at a time and limit flow to less than 260 gpm.

10. The Fuel Pool Demineralizer should be taken out of service if D/P reaches 20 psid on PDS 5150, or FUEL POOL DEMINERALIZER DIFF PRESSURE HI alarm is received on panel 3SF-SFPC7. (ALB-23/5-15 FUEL POOL PNL FP-7 TRBL alarm will also come in.)

11. When transferring water, any associated tank and pool level should be frequently monitored.

12. If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 (3SF-SFPC9) it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

13. Fuel Pool Heat Exchanger outlet temperature should be maintained less than 105°F.

R 14. All systems must be filled and vented before operation of pumps in that system. (Reference 2.6.0.01)

4.0 PRECAUTIONS AND LIMITATIONS (continued)

15. When placing the Fuel Pool Cooling Pumps in service, the Heat Exchanger discharge valves should be throttled as necessary to maintain a discharge pressure:

    a. Greater than 56 psig if lined up to SFP B to prevent FPC Pump run out.

    b. Greater than 73 psig if lined up to Unit 1 NFP to prevent over ranging FT-5100A&B. (maintaining this pressure is more conservative than pump run out)

16. Temperature elements TE-01AV-6537 A-SA and TE-01AV-6537 B-SB, that normally control the Fuel Pool Cooling Pump Room Ventilation Fans, are located on the 261 elevation and not in the FPC Pump Room.

17. When performing Purification Demineralizer rinse, 50 gpm minimum flow should be maintained to protect against Purification pump damage due to low flow.

18. The Fuel Pool Tech Spec minimum levels are to be maintained when rinsing purification demineralizer to RHT.

19. The Spent Fuel Pool Purification system should remain in operation whenever possible to minimize fission product and corrosion product activities in the Spent Fuel Pools. This will help to maintain radiation levels ALARA in the FHB.

20. The FHB Coordinator is responsible for approving any movement of pool or canal water (Reference 2.1.0.016).

21. Prior to transferring water to the RWST, an analysis shall be made using volume of water being transferred and boron concentration to ensure the RWST will not be diluted.

22. Demineralized water, when aligned to the SFP purification system can exceed the piping design pressure rating of 150 psig.

23. The SFP Cooling System should be placed in service when the pool temperature approaches 105°F. The pool temperature shall not be allowed to exceed 112°F during Modes 1-4. This is the maximum temperature assumed in the post-LOCA CCW alignment that will ensure that the pool temperature does not exceed 150°F when CCW is isolated from the SFP Hxs. (Reference 2.7.0.02)

5.0 STARTUP

5.1 Fuel Pool Cooling System Startup

5.1.1 Initial Conditions

1. Attachment 1, Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist, is complete.

2. Attachment 2, Fuel Pool Cooling and Cleanup System Valve Lineup Checklist, is completed.

3. FPC System filled and vented per Section 8.1.

4. NFP A and SFP B are filled.

NOTE:
- CCW is not required to be in service to the specific heat exchanger to run a Fuel Pool Cooling pump for OSTs or Post Maintenance testing.
- CCW must be in service to the proper heat exchanger to maintain temperature within the normal range, prior to exceeding 105°F in the respective fuel pool.

5. CCW is in service to SFP Pool HX A(B) per OP-145 for normal operation.

6. The SFP CCW LOW FLOW Alarm Activation Switch is selected to the inservice SFP HX.

5.1.2 Procedural Steps

NOTE:
- The following Steps line up SFP Train A Cooling System to NFP A or SFP B. To swap trains, the running SFP Cooling Pump should be secured, and the appropriate train aligned per Steps 5.1.2.01 or 5.1.2.02 below.
- The SFP Cooling System should be operated when pool temperature approaches 105°F, or as needed to minimize condensation in the FHB. To prevent higher leakage due to slight contraction of the metal pool liner, the pools should not be cooled to less than 85°F.
- This procedure Section is written for operation of Train A components, with Train B components nomenclature in parentheses.

1. To line up SFP Train A(B) Cooling System to NFP A, perform the following Steps:

   a. Verify shut 1SF-1 (1SF-11), SFP Supply to A(B) Train Isolation.

   b. Verify shut 1SF-8 (1SF-18), Fuel Pool Cooling Supply Isol to Spent Fuel Pool.

   c. Verify open 1SF-9 (1SF-19), NFP to A(B) Train Supply Isolation.

   d. Verify open 1SF-7 (1SF-17), Fuel Pool Cooling Supply Isol to New Fuel Pool.

CAUTION

When aligned to the NFP pump discharge pressure as read on PI-5130A(B), must be greater than 73 psig. The 73 psig will ensure FT-5100A&B is not over ranged.

e. At AEP-1, start Fuel Pool Cooling Pump A (B).

f. Verify 1SF-6(1SF-16), 1&4 A-SA (B-SB) HX Outlet, is throttled to maintain at least 73 psig on PI-5130AS (BS).

g. Verify flow to NFP A by the absence of annunciator on ALB-23/5-19, NEW FP IN LOW FLOW.

2. To line up SFP Train A(B) Cooling System to SFP B, perform the following Steps:

a. Verify shut 1SF-9(1SF-19), NFP to A(B) Train Supply Isolation.

b. Verify shut 1SF-7(1SF-17), Fuel Pool Cooling Supply Isol to New Fuel Pool, for A(B) trains respectively.

c. Verify open 1SF-1(1SF-11), SFP supply to A(B) Train Isolation.

d. Verify open 1SF-8(1SF-18), Fuel Pool Cooling Supply Isol to Spent Fuel Pool, for A(B) trains respectively.

CAUTION

To prevent SFP Cooling Pump runout, 1SF-6(1SF-16), 1&4 A-SA (B-SB) HX Outlet must be throttled to maintain SFP Cooling Pump differential pressure above 43 psid. This can be accomplished by ensuring pump discharge pressure as read on PI-5130A(B) is greater than 56 psig.

e. At AEP-1, start Fuel Pool Cooling Pump A(B).

f. Verify 1SF-6(1SF-16), 1&4 A-SA(B-SB) HX Outlet Isolation, is throttled to maintain at least 56 psig on PI-5130 AS(BS).

g. Verify flow back to SFP B by the absence of annunciator on ALB-23/4-19, SPENT FP IN LOW FLOW.

3. Complete applicable portions of Attachment 4. The idle train components may be marked N/A.

5.2 Fuel Pool Purification System Startup

5.2.1 Initial Conditions

CAUTION

Only one train can be aligned to the SFP Demineralizer due to the 260 gpm flow limitation.

---

1. Attachment 1, Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist, is completed.
2. Attachment 2, Fuel Pool Cooling and Cleanup System Valve Lineup Checklist, is completed.
3. The Fuel Pool Purification System is filled and vented per Section 8.2.

5.2.2 Procedural Steps

NOTE:
- The following Steps lineup Fuel Pool & Refueling Water Purification Pump A to NFP A, or SFP B, with Fuel Pool & Refueling Water Purification Pump B component nomenclature in parentheses.
- Communications must be established between Purification Pump Discharge Valve (216 FHB) and flow instruments on panel 3SF-SFPC7 (236 FHB).
- Aligning the purification system to the Fuel Pool Cooling Train aligned to the Pool that is to be purified will prevent cross connecting pools.

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. Verify open 1SF-1(1SF-11), SFP Supply to A(B) Train Isolation, or 1SF-9(1SF-19), NFP to A(B) Train Supply Isolation.
2. Open 1SF-22, FPC System Supply Isol to Purification System.
3. Open 1SF-21, A Train Supply to Purify Sys, or (1SF-20), 1B-SB FPC Supply to Purify Sys.
4. Open 1SF-29(1SF-28), FP Purify Sys Return Isol to A(B) FPC to SFP, or 1SF-26(1SF-27) FP Purify Sys Return Isol A(B) FPC to NFP.

NOTE: Both bypass valves are opened in Step 5.2.2.05 so that the non running pump has a flow path in case of an inadvertent pump start.

5. Open 1SF-127 and 1SF-137 Fuel Pool Demin A Bypass From Pump 1A and 1B.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

6. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for Fuel Pool and Refueling Water Purification Pump A and B to ON.

5.2 Fuel Pool Purification System Startup (continued)

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarm (FUEL POOLS FLTR 1 & 4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1 & 4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

7. At Panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).
8. Monitor flow on FI-5154A(B) and throttle Fuel Pool Purify Pump 1A(1B) Disch Isol 1SF-123(1SF-133) as necessary to limit flow between 230 and 260 gpm.
9. Open 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to Demin Isolation.
10. Open 1SF-130(1SF-139), Fuel Pool Demin A Outlet to FT-5154A(B) for the running pump, and verify total flow on FI-5154 A(B) remains less than 260 gpm, but greater than 230 gpm.
11. Slowly shut 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(B), while verifying flow on FI-5154 A(B) remains less than 260 gpm.
12. Complete Attachment 5, Fuel Pool Purification Current System Lineup.
13. Complete Attachment 6, Fuel Pool Purification System Startup Valve Lineup Checklist.

5.3 Fuel Pool Skimmer System Startup

5.3.1 Initial Conditions

1. Attachment 1, Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist, is completed.

2. Attachment 2, Fuel Pool Cooling and Cleanup System Valve Lineup Checklist, is completed.

5.3.2 Procedural Steps

NOTE: The Skimmer Unit must be connected to an appropriate skimmer suction valve before opening the valve.

CAUTION

- To prevent excessive draining of fuel pools due to possible Fuel Pool Skimmer System line rupture, do not add extra suction hose to any Skimmer Unit. The maximum hose length is 5 feet.
- Do not line up more than one fuel pool at a time for skimmer operation, unless these pools are connected by removal of pool gates.
- To maintain minimum suction path, a minimum of 4 skimmers must be in service.

---

1. Line up suction to NFP A as follows:
   a. Open 1SF-93 NFP A Common Skimmer Suct Isolation.
   b. Open any of these valves which are attached to a Skimmer Unit:
      (1) 1SF-90, Unit 1 NFP Northwest Skimmer Suction Isol.
      (2) 1SF-91, Unit 1 NFP North Skimmer Suct Isol.
      (3) 1SF-92, Unit 1 NFP NE Skimmer Suct Isol.
2. Line up suction to SFP B as follows:
   a. Verify 1SF-82, Unit 1 SFP Common Skimmer Suct Isolation is open.
   b. Open any of these valves which are attached to a Skimmer Unit:
      (1) 1SF-77, Unit 1 SFP South Skimmer Suct Isol.
      (2) 1SF-78, Unit 1 SFP Northeast Skimmer Suct Isol.
      (3) 1SF-81, Unit 1 SFP Northwest Skimmer Suct Isol.
      (4) 1SF-80, Unit 1 SFP Northwest Skimmer Suct Isol.
      (5) 1SF-79, Unit 1 SFP SW Skimmer Suct Isol.
3. Line up suction to the Main Transfer Canal as follows:
   a. Open 1SF-89, Main Xfer Canal South Skimmer Suct Isol, if attached to a Skimmer Unit.
   b. Verify 1SF-82, Unit 1 SFP Common Skimmer Suct Isolation is open.

5.3 Fuel Pool Skimmer System Startup (continued)

4. Line up suction to the Unit 1 Fuel Transfer Canal as follows:

   a. Open either or both valves if attached to a Skimmer Unit.

      (1) (1SF-94, Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol.

      (2) (1SF-95, Unit 1 Fuel Xfer Canal Southeast Skimmer Suction Isol.

   b. Verify open 1SF-96, Fuel Xfer Canal to Skimmer Pumps Isol.

5. Line up suction to the Unit 2 Fuel Transfer Canal as follows:

   a. Open either or both valves if attached to a Skimmer Unit.

      (1) 2SF-94, Suction to Fuel Trans Canal Unit 2.

      (2) 2SF-95, Suction to Fuel Trans Canal Unit 2.

   b. Verify open 2SF-96, Unit 2 Fuel Transfer Canal to Skimmer Pumps.

6. Line up suction to the Cask Loading Pool as follows:

   a. Open 2SF-100 Cask Loading Pool Skimmer Outlet Isol, if attached to a Skimmer Unit.

   b. Verify open 2SF-96, Fuel Transfer Canal to Skimmer Pumps.

7. If skimmer suction is to be taken on the Cask Loading Pool or Unit 2 Fuel Transfer Canal, then unlock and open the following valves:

   a. 1SF-99, Skimmer Pumps A&B X-tie Isol.

   b. 1SF-100, Skimmer Pumps A&B Disc X-tie.

CAUTION

- Do not line up Fuel Pool Skimmer System to discharge to any pool or canal unless suction is also being taken from that pool or canal, or pool/canal is connected by removal of pool gates.
- Total Fuel Pool Skimmer Pump flow must remain less than 385 gpm to prevent pump run out. To accomplish this, discharge pressure must be maintained greater than or equal to 110 psig.

---

8. If lining up Skimmer Pump discharge to NFP A, open halfway, 1SF-98, Unit 1 NFP Skimmer Return Isol.

9. If lining up Skimmer Pump discharge to SFP B, open halfway, 1SF-87, Skimmer Return Isol to Unit 1 SFP.

10. If lining up Skimmer Pump discharge to the Main Fuel Transfer Canal, open halfway, 1SF-88, Skimmer Return Isol to Main Fuel Xfer Canal.

11. If lining up Skimmer Pump discharge to the Unit 1 Fuel Transfer Canal, open halfway, 1SF-97, Unit 1 Fuel Xfer Canal Skimmer Return Isol.

12. If lining up Skimmer Pump discharge to the Unit 2 Fuel Transfer Canal, unlock and open halfway, 2SF-97, Fuel Transfer Canal Inlet Isolation.

5.3 Fuel Pool Skimmer System Startup (continued)

13. If lining up Skimmer Pump discharge to the Cask Loading Pool, open halfway, 2SF-99, Skimmer Return to Cask Loading Pool (Units 1&2).

14. Fill and vent the Fuel Pool Skimmer Pump and the desired skimmer suction hoses to be used per Section 8.3.

15. At 1-4A1021-5E turn the Fuel Pool Skimmer Pump Bkr to ON.

CAUTION

If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

---

16. At panel 3SF-SFPC7 or 3SF-SFPC9, place the FUEL POOLS SKIMMER PUMP 1 & 4X control switch to START and release. Verify Fuel Pools Skimmer Pump 1 & 4x is running.

17. Throttle the appropriate discharge valve (from Steps 5.3.2.08 - 5.3.2.013 above) to maintain pump discharge 110 to 120 psig.

18. Monitor pool levels and skimmer operation locally.

19. Verify the absence of level alarms for appropriate pools on ALB-23 and panel 3SF-SFPC9.

20. Verify the absence of FP SKIMMER PP 1 & 4x SUCT STNR DIFF PRESS HI alarm on panel 3SF-SFPC9.

21. Complete applicable portions of Attachment 7, Fuel Pool Skimmer Valve Status Checklist.

6.0 NORMAL OPERATIONS

Parameter:	Fuel Pool HX Inlet Temp	less than 105°F
Inst. No.:	TIS-5160 AS(BS)	
Location:	3SF-SFPC7	
Parameter:	Fuel Pool HX Outlet Temp	less than 105°F
Inst. No.:	TIS-5170 AS(BS)	
Location:	3SF-SFPC7	
Parameter:	Fuel Pool Demineralizer 1&4X Pressure Diff	10 psid
Inst. No.:	PDI-5150	
Location:	Local	
Parameter:	Fuel Pool and RW Purification Pumps Disch Press	157 psig
Inst. No.:	PS-5190A(B)	
Location:	Local	
Parameter:	Unit 1 Spent Fuel Pool Temp	85 to 105°F
Inst. No.:	TE 5110 A SA(B SB)	
Location:	3SF-SFPC7	
Parameter:	Unit 1 New Fuel Pool Temp	85 to 105°F
Inst. No.:	TE 5100 A SA(B SB)	
Location:	Local	
Parameter:	Fuel Pool Cooling Pump A(B) Discharge	greater than 56 psig
Inst. No:	PT-5130 A(B)	
Location:	F-R7 (Inst Rack)	
Parameter:	Fuel Pool Cooling Pump Suct Strainer	1.0 to 10.0 psid
Inst. No.:	PDS-5130 AS(BS)	
Location:	F-R7 (Inst Rack)	
Parameter:	Spent Fuel Purification Flow	230 to 260 gpm
Inst. No.:	FT-5154 A(B)	
Location:	3SF-SFPC7	
Parameter:	Fuel Pool Skimmer Pump 1&4X-NNS Discharge Pressure	110 to 120 psig (shut off head 125 psig)
Inst. No.:	PI-5111	
Location:	Local	

7.0 SHUTDOWN

7.1 Fuel Pool Cooling System Shutdown

7.1.1 Initial Conditions

1. Fuel Pool Cooling System is in service per Section 5.1.

7.1.2 Procedural Steps

1. At AEP-1, stop Fuel Pool Cooling Pump A(B).

7.2 Fuel Pool Purification System Shutdown

7.2.1 Initial Conditions

1. Fuel Pool Purification System is in operation per Section 5.2.

7.2.2 Procedural Steps

NOTE: The following Steps shutdown Fuel Pool Purification System Train A, with Train B component nomenclature in parentheses.

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. At panel 3SF-SFPC7 or 3SF-SFPC9, stop Fuel Pools and Refueling Water Purification Pump A(B).
2. At 1-4A1021-1D and 1-4B1021-5E turn the breaker for Fuel Pool and Refueling Water Purification Pump A and B to OFF.
3. Shut 1SF-22, FPC System Supply Isol to Purification System.
4. Shut 1SF-21, A Train Supply to Purify Sys, (1SF-20, 1B-SB FPC Supply to Purify Sys).
5. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).
6. Shut 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to Demin.
7. Shut 1SF-137 (1SF-127), Fuel Pool Purif Demin A Bypass from Pump 1B (1A).
8. Shut 1SF-29(1SF-28), FP Purify Sys Return Isol to A(B) FPC to Spent Fuel Pool, or shut 1SF-26(1SF-27), FP Purify Sys Return Isol to A(B) FPC to NFP.
9. Complete Attachment 8, Fuel Pool Purification Shutdown Checklist Section A and G. Sections not used may be marked N/A.
10. Complete Attachment 5, Fuel Pool Purification Current System Lineup.
11. Complete Attachment 6, Fuel Pool Purification System Startup Valve Lineup Checklist.

7.3 Fuel Pool Skimmer System Shutdown

7.3.1 Initial Conditions

1. The system is in operation per Section 5.3.

7.3.2 Procedural Steps

CAUTION

If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

---

1. At panel 3SF-SFPC7 or 3SF-SFPC9, stop the Fuel Pool Skimmer Pump.
2. At 1-4A1021-5E turn the Fuel Pool Skimmer Pump breaker to OFF.
3. Shut the following valves opened in Section 5.3 as indicated by the completed portions of Attachment 7.
   a. If Skimmer was skimming NFP A:
      (1) Shut 1SF-90, Unit 1 NFP Northwest Skimmer Suction Isol.
      (2) Shut 1SF-91, Unit 1 NFP North Skimmer Suc Isol.
      (3) Shut 1SF-92, Unit 1 NFP NE Skimmer Suct Isol.
      (4) Shut 1SF-93, Unit 1 NFP Common Skimmer Suct Isolation.
      (5) Shut 1SF-98, Unit 1 NFP Skimmer Return Isol.
   b. If Skimmer was skimming SFP B:
      (1) Shut 1SF-77, Unit 1 SFP South Skimmer Suct Isol.
      (2) Shut 1SF-78, Unit 1 SFP Northeast Skimmer Suct Isol.
      (3) Shut 1SF-81, Unit 1 SFP Northwest Skimmer Suct Isol.
      (4) Shut 1SF-80, Unit 1 SFP Northwest Skimmer Suct Isol.
      (5) Shut 1SF-79, Unit 1 SFP SW Skimmer Suct Isol.
      (6) Shut 1SF-87, Skimmer Return Isol to Unit 1 SFP.
   c. If Skimmer was skimming Main Fuel Transfer Canal:
      (1) Shut 1SF-89, Main Xfer Canal South Skimmer Suct Isol.
      (2) Shut 1SF-88, Skimmer Return Isol to Main Fuel Xfer Canal.
   d. If Skimmer was skimming Unit 1 Fuel Transfer Canal:
      (1) Shut 1SF-94, Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol.
      (2) Shut 1SF-95, Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol.
      (3) Shut 1SF-97, Unit 1 Fuel Xfer Canal Skimmer Return Isol.

7.3 Fuel Pool Skimmer System Shutdown (continued)

e. If Skimmer was skimming Unit 2 Fuel Transfer Canal:

(1) Shut and lock 2SF-97, Fuel Transfer Canal Inlet Isol.

(2) Shut 2SF-94, Suction to Fuel Trans Canal Unit 2.

(3) Shut 2SF-95, Suction to Fuel Trans Canal Unit 2.

f. If Skimmer was skimming Cask Loading Pool:

(1) Shut 2SF-99, Skimmer Return to Cask Loading Pool (Units 1&2)

(2) Shut and lock 1SF-100, Skimmer Pumps A&B Disc X-tie

(3) Shut 2SF-100, Cask Loading Pool Skimmer Outlet Isol.

(4) Shut and lock 1SF-99, Skimmer Pumps A&B X-tie Isol.

4. Complete applicable portions of Attachment 9, Fuel Pool Skimmer Shutdown Valve Lineup Checklist.

8.0 INFREQUENT OPERATIONS

8.1 Fill and Vent of Fuel Pool Cooling System

8.1.1 Initial Conditions

1. NFP A and SFP B are at a normal level.

2. Attachment 2, Fuel Pool Cooling and Cleanup System Valve Lineup Checklist is complete.

NOTE: Planning venting evolutions of any potentially radioactive system with Health Physics concurrence and assistance will minimize the risk of contamination or overexposure.

8.1.2 Procedural Steps

1. Open 1SF-37, FPC Pump 1&4A-SA Casing Vent, or (1SF-59), 1&4B-SB Fuel Pool Cooling Pump Casing Vent, until a solid stream of water issues, then shut 1SF-37(1SF-59).

2. Open 1SF-43 1&4A-SA Heat Exchanger Tube Side Vent Isol or, (1SF-67), Fuel Pool 1&4B-SB Heat Exchanger Tube Side Vent, until a solid stream of water issues, then shut 1SF-43 (1SF-67).

3. Open 1SF-221, Fuel Pool Cooling Supply to Purify Sys Vent Isol until a solid stream of water issues, then shut 1SF-221.

4. Open 1SF-222, New Fuel Pool to B Train Vent Isol until a solid stream of water issues, then shut 1SF-222.

5. Open 1SF-214, NFP Supply to A Train Vent until a solid stream of water issues, then shut 1SF-214.

6. Open 1SF-223, NFP and SFP to B Train Vent isolation until a solid stream of water issues, then shut 1SF-223.

7. Open 1SF-224, SFP to A Train Vent until a solid stream of water issues, then shut 1SF-224.

8. Throttle shut 1SF-4(1SF-14) 1&4A-SA(1&4B-SB) Fuel Pool Cooling Pump A(B) Discharge valve 5 to 10% open.

9. Start A(B) FPC Pump per Section 5.1.

10. Slowly open 1SF-4(1SF-14) Fuel Pool Cooling Pump 1&4A-SA(1&4B-SB) Disch Isol.

11. At AEP-1, Stop Fuel Pool Cooling Pump A(B).

12. If necessary, makeup to SFP B per Section 8.4.

13. Complete applicable portions of Attachment 10, Fuel Pool Cooling Fill and Vent Valve Lineup Checklist.

8.2 Fill and Vent of Fuel Pool Purification System

8.2.1 Initial Conditions

1. SFP B is at normal level.

2. Attachment 2, Fuel Pool Cooling and Cleanup System Valve Lineup Checklist, is completed.

NOTE: Planning venting evolutions of any potentially radioactive system with Health Physics concurrence and assistance will minimize the risk of contamination or overexposure.

8.2.2 Procedural Steps

1. Open 1SF-21, A Train Supply to Purify Sys, or (1SF-20), 1B-SB FPC Supply to Purify Sys.

2. Open 1SF-29(1SF-28), FP Purify Sys Ret Isol to A(B) FPC to SFP.

3. Open 1SF-22, FPC System Supply Isol to Purification System.

4. Open 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B).

5. Slowly open 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to Demin, to gravity fill the demineralizer.

6. Open 1SF-171, Fuel Pool Demin A Vent Isolation.

7. Open 1SF-172, Fuel Pool Demin A Vent Isolation.

8. Open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

9. When a solid stream of water issues from the vent:

   a. Shut 1SF-171, Fuel Pool Demineralizer A Vent Isol.

   b. Shut 1SF-172, Fuel Pool Demineralizer A Vent Isol.

10. Request Radwaste Control Room Operator to fill and vent the Fuel Pools and Refueling Water Purification Filter.

11. When the Fuel Pools and Refueling Water Purification Filter has been filled and vented, perform the following:

    a. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

    b. Shut 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to 1 Demin.

12. If the Fuel Pool Purification System is to be placed in operation, proceed with appropriate Section of this OP. If the Fuel Pool Purification System is not to be placed in operation, perform the following:

    a. Shut 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B).

    b. Shut 1SF-28(1SF-29), FP Purify Sys Ret Isol to B(A) FPC to SFP.

    c. Shut 1SF-22, FPC System Supply Isol to Purification System.

    d. Shut 1SF-21, A Train Supply to Purify Sys, or (1SF-20), 1B-SB Fuel Pool Cooling Supply to Purify Sys.

13. Complete applicable portions of Attachment 11.

8.3 Fill and Vent of Fuel Pool Skimmer System

8.3.1 Initial Conditions

1. SFP B is at normal level.

2. Attachment 2, Fuel Pool Cooling and Cleanup System Valve Lineup Checklist, is completed.

3. Steps 5.3.2.01 through 5.3.2.013 have been performed as necessary.

NOTE: Planning venting evolutions of any potentially radioactive system with Health Physics concurrence and assistance will minimize the risk of contamination or overexposure.

8.3.2 Procedural Steps

1. Request Radwaste Control Room to fill and vent the Fuel Pool Skimmer Filter 1&4X-NNS.

NOTE: 1DW-527 is a locked shut valve to prevent inadvertent dilution.

2. Open 1DW-527, DW Iso to Fuel Pools Skimmer Pmp Strainer 1&4X-NNS, to fill the Fuel Pool Skimmer System.

3. Open 1SF-220, Fuel Pools Skimmer Pmp Suction Strainer 1&4X-NNS Vent Vlv, when a solid stream of water issues shut 1SF-220.

4. Open 1SF-110 DV1, PI-5111 Instrument Vent, when a solid stream of water issues shut 1SF-110 DV1.

5. Shut 1SF-83, Fuel Pools Skimmer Pump A Suction Isol, to backfill skimmer suction hoses.

6. When the desired skimmer suction hoses are filled, open 1SF-83.

7. Lock shut 1DW-527.

8. Return to Step 5.3.2.015, if applicable.

9. Complete applicable portions of Attachment 12.

8.4 Makeup to SFP B with Demin Water with the Purification System in Service

8.4.1 Initial Conditions

1. Attachments 1 and 2 complete.
2. RWST or Demineralized Water is available per OP-112 and OP-143.03, respectively.
3. Purification in service to SFP B.

8.4.2 Procedural Steps

NOTE: 1SF-201, Demin WT Supply Isol to Fuel Pool Purify, is a locked valve to prevent inadvertent dilution.

CAUTION

When transferring water, a continuous watch of the fuel pool/canal being filled should be maintained.

---

1. While ensuring that flow through the demineralizer on FI-5154A(B) remains less than 260 gpm, slowly open 1SF-201, Demin WT Supply Isol to the Fuel Pool Purify.

NOTE: If demineralizer flow drops below 230 gpm an alarm will be generated on 3SF-SFPC7.

2. If necessary, to limit flow through the demineralizer to less than 260 gpm, throttle open 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B).
3. When makeup is complete, shut 1SF-201, Demin Water Supply to Fuel Pool Purification.
4. If opened in Step 8.4.2.02 and while ensuring that flow through the demineralizer remains between 230 gpm and 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B).
5. Complete applicable portions of Attachment 13.

8.5 <u>Makeup to Fuel Pools, Xfer Canals and Cask Loading Pools using RWST or Demin Water</u>

8.5.1 <u>Initial Conditions</u>

1. Attachments 1 and 2 complete.
2. RWST or Demin Water is available per OP-112 or OP-143.03, respectively.
3. Purification System is filled and vented.
4. Purification System secured per Section 7.2.

8.5.2 <u>Procedural Steps</u>

1. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.
2. To makeup to SFP B, open 1SF-29(1SF-28), FP Purify Sys Return Isol to A(B) FPC to Spent Fuel Pools.
3. To makeup to NFP A, open 1SF-26(1SF-27), FP Purify System Return Isol A(B) FPC to NFP.
4. To makeup to the Unit 1 Fuel Transfer Canal, open 1SF-192, Fuel Pool Purify Sys Return to Xfer Canal A.

<u>NOTE</u>: The following Step is also an alternate method of filling the Cask Loading Pool if Fuel Pool Gate #8 is installed.

5. For makeup to the Cask Loading Pool perform the following:
   a. Open 1SF-206, Fuel Pool Purify Return Isol to Unit 2 & 3.
   b. Open 2SF-205, Fuel Pool Purify to Cask Loading Pool.
   c. Open 2SF-141, Fuel Pool Purify Supply to Cask Loading Pool.
   d. Open 2SF-188, Fuel Pool Purify Supply Isol to Cask Loading Pool.
   e. Open 2SF-203, Fuel Pool Purify supply to Cask Loading Pool.
6. If the RWST is to be used for makeup, perform the following:
   a. Direct maintenance to install a -15 to 100 PSIG Heise pressure gauge at 1SF-152(1SF-162), Fuel Pool Purif Pump 1A(1B) Suct Isol after St SF-S6(SF-S5).
   b. Open 1SF-152(1SF-162).
   c. Open 1SF-193, RWST Supply Isol to Fuel Pool Purify Sys.

<u>CAUTION</u>

Opening 1CT-23 makes the RWST inoperable, due to purification lines not being seismically qualified. Throttling will minimize potential level loss. This is a one hour action in Modes 1 - 4.

---

   d. Throttle open 1CT-23, RWST to SFP Pump Suction approximately half way open.

8.5 <u>Makeup to Fuel Pools, Xfer Canals and Cask Loading Pools using RWST or Demin Water</u> (continued)

<u>NOTE</u>: 1SF-201, Demin WT Supply Isolation to Fuel Pool Purify, is a locked valve to prevent inadvertent dilution.

7. If using demineralized water for makeup, open 1SF-201.

8. Establish communications between the Operator controlling pumps and the Operator visually monitoring fill.

9. Open 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From Pump 1A(1B).

<u>NOTE</u>:

- If makeup is via demineralized water and the starting of a Purification Pump is deemed not necessary, then Step 8.5.2.015 should be started when the desired level is reached.
- As long as flow is not allowed through the Fuel Pool Demineralizer, Fuel Pool and Refueling Water Purification Pump A(B) flow, as indicated on FT-5154 A(B), may be increased to 325 gpm by throttling open 1SF-123(1SF-133), Fuel Pool Purify Pump 1A(1B) Disch Isol.
- Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

10. At 1-4A1021-1D and 1-4B1021-5E turn the breaker for Fuel Pool and Refueling Water Purification Pump A and B to ON.

<u>CAUTION</u>

If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

---

11. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).

8.5 Makeup to Fuel Pools, Xfer Canals and Cask Loading Pools using RWST or Demin Water (continued)

NOTE: The intent of throttling 1CT-23 is to minimize losses from the RWST in the event of a seismic event.

CAUTION

Fuel Pool and Refueling Water Purification Pump A(B) may exhibit signs of cavitation during the following Steps. Throttling 1CT-23 open until the cavitation stops will prevent pump damage.

---

12. If the RWST is to be used for makeup, perform the following:
    a. Station an operator at Fuel Pool and Refueling Water Purification Pump A(B) to monitor for cavitation.
    b. Throttle 1CT-23 to obtain a suction pressure of approximately 1 to 5 psig, as indicated on the test gauge installed in Step 8.5.2.06.a.
13. When the desired level is reached, stop the Fuel Pool and Refueling Water Purification Pump and turn both supply breakers to OFF.
14. Shut all of the following valves, if opened in Steps 8.5.2.02 through 8.5.2.07:

NOTE: Shutting 1CT-23 will restore the RWST to operable.

    a. Shut 1CT-23, RWST to SFP Pump Suction.
    b. Shut 1SF-152(1SF-162).
    c. Shut 1SF-193, RWST Supply Isol to Fuel Pool Purify Sys.
    d. Lock Shut 1SF-201, Demin WT System Isol to Fuel Pool Purify System.
    e. Shut 1SF-26(1SF-27), FP Purify System Return Isol to A(B) FPC to NFP.
    f. Shut 1SF-192, Fuel Pool Purify Sys Return to Xfer Canal A.
    g. Shut 1SF-29(1SF-28), FP Purify Sys Return Isol to A(B) FPC to Spent Fuel Pools.
    h. Shut 1SF-206, Fuel Pool Purify Return Isol to Unit 2 & 3.
    i. Shut 2SF-205, Fuel Pool Purify to Cask Loading Pool.
    j. Lock shut 2SF-141, Fuel Pool Purify Supply to Cask Loading Pool.
    k. Shut 2SF-188, Fuel Pool Purify Supply Isol to Cask Loading Pool.
    l. Shut 2SF-203, Fuel Pool Purify Supply to Cask Loading Pool.

8.5 Makeup to Fuel Pools, Xfer Canals and Cask Loading Pools using RWST or Demin Water (continued)

15. Shut 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From Pump 1A(1B).

16. Direct maintenance to remove the Heise pressure gauge at 1SF-152(1SF-162), if installed in Step 8.5.2.06.a.

17. Open 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.

18. Complete applicable portions of Attachment 13.

8.6 Makeup to Pool or Canal using Skimmer System with Skimmer System in Service to That Pool

8.6.1 Initial Conditions

1. Attachments 1 and 2 complete.

2. Skimmer System in service to Pool to be filled per Section 5.3.

3. Demineralized Water is available per OP-143.03.

8.6.2 Procedural Steps

NOTE:
- This method is a relatively slow method of adding water to the pool or canal that has the skimmer in service.
- 1DW-527, DW Isol to Fuel Pools Skimmer Pmp Strainer 1&4X-NNS is a locked shut valve.

1. Unlock and open 1DW-527, DW Isol to Fuel Pools Skimmer Pmp Strainer 1&4X-NNS.

2. When the desired level is reached, Lock shut 1DW-527.

3. Complete applicable portions of Attachment 13.

8.7 Refueling Cavity Purification

8.7.1 Initial Conditions

1. Attachments 1 and 2 are completed.
2. Refueling Coordinator or Unit SCO has determined that Refueling Cavity Purification is required.
3. Fuel Pool Purification System is filled and vented with borated water of at least the same concentration as the Refueling Cavity.
4. 1SF-201, Demin WT Supply Isolation to Fuel Pool Purify Sys, has been verified locked shut.
5. Fuel Pool Purification System is secured per Section 7.2.

8.7.2 Procedural Steps

NOTE: 1SF-118, 1SF-119, 1SF-144 and 1SF-145 are locked Containment Isolation Valves. Tech Spec 3.6.1.1 should be referenced before opening these valves.

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.
2. Shut 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.
3. Open 1SF-212, Unit 1 Refuel Cav Purify Suct Isol.
4. Open 1SF-210, Unit 1 Refuel Cavity Purify Return.
5. Open 1SF-120, Unit 1 Refuel Cav to Fuel Pool Purify Pumps 1A & 1B.
6. Open 1SF-143, Fuel Pool Purify Sys A Supply to Refuel Cav.
7. Open 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From Pump 1A and 1B, respectively.
8. Open 1SF-118, Refuel Cavity Purification Suct CIV.
9. Open 1SF-145, Refuel Cavity Purification Discharge CIV (IRC).
10. Open 1SF-119, Refuel Cavity Purification Suction CIV (ORC).
11. Open 1SF-144, Refueling Cavity Purification Discharge CIV (ORC).

8.7 Refueling Cavity Purification (continued)

NOTE:
- The following Steps line up Fuel Pool and Refueling Water Purification Pump A to the Refueling Cavity, with Pump B component nomenclature in parentheses.
- Communications must be established between Purification Pump Discharge Valve (216 FHB), Containment 286 elev, and flow instruments on panel 3SF-SFPC7 (236 FHB).
- Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

CAUTION

Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.

---

12. At 1-4A1021-1D and 1-4B1021-5E, turn the supply breaker for the Fuel Pools and Refueling Water Purification Pumps A and B to ON.

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarms (FUEL POOLS FLTR 1&4A OUTLET FLOW LO and alarm FUEL POOLS FLTR 1&4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

---

13. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).
14. Monitor flow on FI-5154A(B), and throttle 1SF-123(1SF-133), Fuel Pool Purify Pump 1A(1B) Disch Isol, as necessary to control flow between 230 gpm and 260 gpm.
15. Slowly open 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to 1 Demin.
16. Open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B), and verify total flow on FI-5154A(B) remains less than 260 gpm.
17. While verifying flow on FI-5154A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B).
18. Complete Attachment 5.
19. Complete applicable portions of Attachment 14.

8.7 Refueling Cavity Purification (continued)

20. When the Refueling Coordinator and Unit SCO determines that Refueling Cavity purification is no longer required, perform the following Steps:

NOTE: If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 (3SF-SFPC9) it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

a. Stop Fuel Pool and Refueling Water Purification Pump A or B.

b. At 1-4A1021-1D and 1-4B1021-5E, turn the supply breaker for the Fuel Pools and Refueling Water Purification Pumps A and B to OFF.

c. Lock shut 1SF-118, Refuel Cavity Purification Suct CIV.

d. Lock shut 1SF-145, Refuel Cavity Purification Discharge CIV (IRC).

e. Lock shut 1SF-119, Refuel Cavity Purification Suction CIV (ORC).

f. Lock shut 1SF-144, Refueling Cavity Purification Discharge CIV(ORC).

g. Shut 1SF-120, Unit 1 Refuel Cav to Fuel Pool Purify Pumps 1A & 1B.

h. Shut 1SF-143, Fuel Pool Purify Sys A Supply to Refuel Cav.

i. Shut 1SF-212, Unit 1 Refuel Cavity Purify Suct Isol.

j. Open 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.

k. Open 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.

l. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

m. Shut 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to 1 Demin.

21. Complete Attachment 8, Sections F and G. Sections not used may be marked N/A.

22. Complete Attachment 5.

8.8 Transfer Canal or Refueling Cavity or Cask Loading Pool Drain to RWST or RHT

8.8.1 Initial Conditions

1. Volume available in RWST or RHT for drainage.

2. Attachment 1 and 2 are completed.

3. The associated Transfer Canal or Pool to be drained is isolated from all other pools or canals by installed Fuel Pool Gates.

4. Fuel Pool Purification is secured per Section 7.2.

5. The Fuel Pools and Refueling Water Purification Filter has been Filled and Vented per OP-120.02.39.

6. Attachment 26 has been performed such that when the transfer is complete, the RWST boron concentration will be greater than or equal to 2400 ppm.

8.8.2 Procedural Steps

1. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.

2. Shut 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.

CAUTION

Do not drain the Transfer Canal unless directed by the Refueling Coordinator and Superintendent - Shift Operations.

---

3. Perform the applicable valve alignment for the area to be drained as follows:

   a. To drain the Unit 1 Fuel Transfer Canal perform the following:

      (1) Open, 1SF-146, Unit 1 Fuel Xfer Canal East Drain Isol.

      (2) Open, 1SF-147, Unit 1 Fuel Xfer Canal West Drain Isol.

      (3) Open, 1SF-148, Transfer Canal A Supply Isol to Purify Sys.

CAUTION

The Refueling Cavity shall not be drained until directed by the Refueling Coordinator and the Superintendent - Shift Operations.

---

   b. To drain the Refueling Cavity, perform the following:

NOTE: 1SF-118 and 1SF-119 are locked Containment Isolation valves. Tech Spec 3.6.1.1 should be referenced before opening these valves.

      (1) Unlock and open 1SF-118, Refuel Cavity Purification Suct CIV.

      (2) Unlock and open 1SF-119, Refuel Cavity Purification Suction CIV (ORC).

      (3) Open 1SF-212, Unit 1 Refuel Cav Purify Suct Isol.

      (4) Open 1SF-120, Unit 1 Refuel Cavity to Fuel Pool Purify Pumps 1A & 1B.

8.8 <u>Transfer Canal or Refueling Cavity or Cask Loading Pool Drain to RWST or RHT</u> (continued)

c. To drain the Main Fuel Transfer Canal, perform the following:

(1) Open 1SF-196, Fuel Xfer Canal NW Supply Isol to Fuel Pool Purify.

(2) Open 1SF-197, Fuel Xfer Canal N Supply Isol to Fuel Pool Purify.

(3) Open 1SF-198, Fuel Xfer Canal NE Supply Isol to Fuel Pool Purify.

(4) Open 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purify Sys Comm.

d. To drain the Cask Loading Pool, Perform the following:

(1) Open 2SF-199, Cask Loading Pools to Fuel Pool Purify Suct.

(2) Open 2SF-200, Cask Loading Pool to Fuel Pool Purification Suct.

(3) Open 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask Pl.

4. Determine desired drain tank and perform the applicable valve alignment as follows:

a. To drain to the RHT, perform the following Steps:

(1) Open 1SF-188, Fuel Pool Purify Return Isolation.

(2) Have Radwaste Control Room Operator open 3BR-124, Unit 1&4 SFPCS Purify Pumps Disch to BRS.

(3) Verify 3BR-130, Inlet to A RHT is locked open.

b. To drain to the RWST perform the following Steps:

(1) Open 1SF-187, Fuel Pool Purify Return to RWST.

(2) Check open 1CT-98, SFPC Purify Pump Disch to RWST Isol Vlv

(3) Check open 1CT-101, Spray Hdr Recirc Line RWST Isol Vlv.

(4) Check open 1CT-21, RWST Inlet From Recirc Line Valve.

5. Open 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From Pump 1A (1B).

<u>NOTE</u>: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

6. At 1-4A1021-1D and 1-4B1021-5E, turn the breakers for Fuel Pool and Refueling Water Purification Pump A and B to ON.

8.8 Transfer Canal or Refueling Cavity or Cask Loading Pool Drain to RWST or RHT (continued)

NOTE:
- Fuel Pool and Refueling Water Purification Pump flow should be limited to 150 gpm to accommodate FT-6703 range of 0 to 150 gpm when draining to the RHT.
- If the Refueling Cavity is being drained, communications must be established between the Operator watching Refueling Cavity level and the Operator at panel 3SF-SFPC7 (3SF-SFPC9) controlling the pump.

CAUTION

If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

---

7. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).

8. Throttle 1SF-123(1SF-133), Fuel Pool Purify Pump 1A(1B) Disch Isol, as necessary to limit flow to 325 gpm to the RWST, or 100 gpm to the RHT (FI-5154A or B).

NOTE: Drain points should be monitored closely to ensure the Purification pumps operate with adequate suction pressure to prevent pump cavitation.

9. Complete Attachment 5 and denote in comment Section the Section used to open drain and discharge paths.

10. On completion of transfer, stop Fuel Pool and Refueling Water Purification Pump A(B) and turn the breakers at 1-4A1021-1D and 1-4B1021-5E to OFF.

11. Notify Radwaste Control Room that transfer is complete if the Transfer Canal or Refueling Cavity was drained to the RHT.

12. If drain path was to the RHT, perform the following:

    a. Shut 1SF-188, Fuel Pool Purify Return Isolation.

    b. Have Radwaste Control Room shut 3BR-124, Unit 1&4 SFPCS Purify Pump Disc to BRS.

13. If drain path was to the RWST, shut 1SF-187, Fuel Pool Purify Return to RWST.

14. Perform the applicable valve lineup for the area that was being drained as follows:

    a. If the Unit 1 Fuel Transfer Canal was being drained, perform the following:

        (1) Shut 1SF-146, Unit 1 Fuel Xfer Canal East Drain Isol.

        (2) Shut 1SF-147, Unit 1 Fuel Xfer Canal West Drain Isol.

        (3) Shut 1SF-148, Transfer Canal A Supply Isol to Purify Sys.

b. If the Refueling Cavity was being drained, perform the following:

(1) Lock shut 1SF-118, Refuel Cavity Purification Suct CIV.

(2) Lock shut 1SF-119, Refuel Cavity Purification Suction CIV (ORC).

(3) Shut 1SF-212, Unit 1 Refuel Cav Purify Suct Isol.

(4) Shut 1SF-120, Unit 1 Refuel Cavity to Fuel Pool Purify Pumps 1A & 1B.

c. If the Main Fuel Transfer Canal was being drained, perform the following:

(1) Shut 1SF-196, Fuel Xfer Canal NW Supply Isol to Fuel Pool Purify.

(2) Shut 1SF-197, Fuel Xfer Canal N Supply Isol to Fuel Pool Purify.

(3) Shut 1SF-198, Fuel Xfer Canal NE Supply Isol to Fuel Pool Purify.

(4) Shut 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purify Sys Comm.

d. If the Cask Loading Pool was being drained, then perform the following:

(1) Shut 2SF-199, Cask Loading Pools to Fuel Pool Purify Suct.

(2) Shut 2SF-200, Cask Loading Pool to Fuel Pool Purification Suct.

(3) Shut 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask Pl.

15. Open 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.

16. Open 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.

17. Shut 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From Pump 1A (1B).

18. Complete Attachment 5.

19. Complete Attachment 15, for applicable valves operated.

20. If drain path was to the RWST, perform Section 8.9, RWST Purification, and sample to verify boron concentration.

8.9 RWST Purification

8.9.1 Initial Conditions

1. Attachments 1 and 2 are complete.
2. Chemistry has determined the required amount of time purification will be needed.
3. Fuel Pool Purification System is filled and vented.

NOTE: Because RWST purification will make the RWST inoperable, it should normally be performed in Modes 5 and 6, while the BAT is an operable Boration Flow Path.

8.9.2 Procedural Steps

CAUTION

- Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.
- The Fuel Pool Purification System shall not be aligned to any other water source or Pool concurrent with RWST Purification.
- Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. Verify the Fuel Pool Purification System is secured from previous running procedure.
2. Verify Containment Spray Pumps are not running on recirculation to RWST.
3. Verify the Fuel Pool Purification System is not aligned to any other water source or pool by performing the following:
   a. Verify, from Radwaste Control Room, that 1ED-136, RCDT pump disch to SFPCS RW Purify, is shut.
   b. Verify the following valves shut:
      (1) 1SF-120, Unit 1 Refuel Cav to Fuel Pool Purify Pumps 1A & 1B.
      (2) 1SF-143, Fuel Pool Purify Sys A Supply to Refuel Cav.
      (3) 1SF-188, Fuel Pool Purify Return Isolation.
      (4) 1SF-189, Fuel Pool Purify Return to SFP Downstream 1SF-141.
      (5) 1SF-10, RWST to A Supply Isolation.
4. Shut 1SF-205, Fuel Pool Purify Return Isol to Fuel Pools.
5. Shut 1SF-149, Fuel Pool Purify Sys Supply Isol.
6. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.
7. Shut 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.

CAUTION

Opening 1CT-23 makes the RWST inoperable, due to purification lines not being seismically qualified. This is a one hour action in Modes 1 - 4.

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8. Open 1CT-23, RWST to SFP Pump Suction.
9. Open 1SF-193, RWST Supply Isol to Fuel Pool Purify Sys.
10. Open 1SF-187, Fuel Pool Purify Return to RWST.
11. Verify open 1CT-98, SFPC Purify Pump Disch to RWST.
12. Verify open 1CT-101, Spray Header Recirc Line RWST Isol Vlv.
13. Verify open 1CT-21, RWST Inlet From Recirc Line Valve.

NOTE:
- The following Steps line up Fuel Pool and Refueling Water Purification Pump A to the RWST, with Fuel Pool and Refueling Water Purification Pump B component nomenclature in parentheses.
- Communications must be established between Purification Pump Discharge Valve (216 FHB) and flow instruments on Panel 3SF-SFPC7 (236 FHB).

14. Open 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From pump 1A and 1B.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

15. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for the Fuel Pool and Refueling Water Purification Pump A and B to ON.

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarm (FUEL POOLS FLTR 1&4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1&4 OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the demineralizer.

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16. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).
17. Monitor flow on FI-5154A(B) and throttle Fuel Pool Purify Pump 1A(1B) Disch Isol, 1SF-123(1SF-133) as necessary to control flow between 230 gpm and 260 gpm.
18. Slowly open 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to 1 Demin.
19. Open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B), and verify total flow on FI-5154A(B) remains between 230 and 260 gpm.
20. While verifying flow on FI-5154A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B).

8.9 RWST Purification (continued)

21. Complete Attachment 5.

22. When RWST purification is complete, perform the following Steps:

    a. Stop Fuel Pool and Refueling Water Purification Pump A(B).

    b. Open both pumps supply breakers at 1-4A1021-1D and 1-4B1021-5E.

NOTE: Shutting 1CT-23 will restore the RWST to operable.

    c. Shut 1CT-23, RWST to SFP Pump Suction.

    d. Shut 1SF-193, RWST Supply Isol to Fuel Pool Purify Sys.

    e. Shut 1SF-187, Fuel Pool Purify Return to RWST.

    f. Open 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.

    g. Open 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.

    h. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

    i. Shut 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to 1 Demin.

    j. Open 1SF-149, Fuel Pool Purify Sys Supply Isol.

    k. Open 1SF-205, Fuel Pool Purify Return Isol to Fuel Pools.

23. Complete Attachment 8, Sections E and G. Sections not used may be marked N/A.

24. Complete Attachment 5.

8.10 Cask Loading Pool Purification

8.10.1 Initial Conditions

1. Attachments 1 and 2 are completed.
2. Cask Loading Pool filled.
3. Purification System is secured from previous running Section.
4. Purification System is filled and vented.

8.10.2 Procedural Steps

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

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1. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.
2. Shut 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.
3. Open 1SF-206, Fuel Pool Purify Return Isol to Unit 2 & 3.
4. Open 2SF-205, Fuel Pool Purify to Cask Loading Pool
5. Open 2SF-141, Fuel Pool Purify Supply to Cask Loading Pool.
6. Open 2SF-188, Fuel Pool Purify Supply Isol to Cask Loading Pool.
7. Open 2SF-203, Fuel Pool Purify Supply to Cask Loading Pool.
8. Open 2SF-199, Cask Loading Pools to Fuel Pool Purify Suct.
9. Open 2SF-200, Cask Loading Pool to Fuel Pool Purification Suction.
10. Open 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask Pool.

NOTE: Both bypass valves are opened in Step 8.10.2.011 so that the non running pump has a flow path in case of an inadvertent pump start.

11. Open 1SF-127 and 1SF-137, Fuel Pool Purify Demin A Bypass From Pump 1A and 1B.

NOTE:
- The following Steps line up Fuel Pool and Refueling Water Purification Pump A to the Cask Loading Pool, with Pump B component nomenclature in parentheses.
- Communications must be established between Purification Pump Discharge Valve (216 FHB) and flow instruments on panel 3SF-SFPC7 (236 FHB).
- Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 which results in an AEP-1 alarm.

CAUTION

Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.

---

12. At 1-4A1021-1D and 1-4B1021-5E, turn the supply breaker for Fuel Pools and Refueling Water Purification Pump A and B to ON.

CAUTION

If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

---

13. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pools and Refueling Water Purification Pump A(B).

CAUTION

Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarm (FUEL POOLS FLTR 1&4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1&4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

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14. Throttle 1SF-123(1SF-133), Fuel Pool Purify Pump 1A(1B) Disch Isol, as necessary to control flow as indicated on FI-5154A(B) to between 230 gpm and 260 gpm.
15. Slowly open 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to 1 Demin.
16. Open 1SF-130(1SF-139) Fuel Pool Purify Demin A Outlet to FT-5154A(B) and verify total flow on FI-5154 A(B) remains less than 260 gpm, but greater than 230 gpm.
17. Slowly shut 1SF-127(1SF-137), Fuel Pool Purify Demin A Bypass From Pump 1A(1B), while verifying flow on FI-5154A(B) remains less than 260 gpm.
18. Complete Attachment 5.
19. To secure Cask Loading Pool Purification perform the following Steps:

NOTE: If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 (3SF-SFPC9) it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

a. Stop the Fuel Pool and Refueling Water Purification Pump A(B) and turn both supply breakers to OFF.

b. Shut 2SF-199, Cask Loading Pools to Fuel Pool Purify Suct.

c. Shut 2SF-200, Cask Loading Pool to Fuel Pool Purification Suction

8.10 Cask Loading Pool Purification (continued)

d. Shut 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask Pool.

e. Shut 1SF-206, Fuel Pool Purify Return Isol to Unit 2 & 3.

f. Shut 2SF-188, Fuel Pool Purify Supply Isol to Cask Loading Pool.

g. Shut 2SF-203, FP Purify Supply to Cask Loading Pool.

h. Lock shut 2SF-205, Fuel Pool Purify to Cask Loading Pool.

i. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

j. Shut 1SF-126(1SF-136), Fuel Pool Purify Filter 1A(1B) Supply to Demin.

k. Lock shut 2SF-141, Fuel Pool Purify Supply to Cask Loading Pool.

l. Open 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.

m. Open 1SF-191, Fuel Pool Purify Return to SFP Dnstream 1SF-205.

20. Complete Attachment 8, Sections B and G. Sections not used may be marked N/A.

21. Complete Attachment 5.

8.11 Fuel Pool Demineralizer Resin Change and Rinse

8.11.1 Initial Conditions

1. Fuel Pool Purification System is Shutdown per Section 7.2.

CAUTION

Demineralizer resin change and rinse should not be performed during refueling unless the SFP is isolated from the refueling cavity due to possible dilution.

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2. Rinsing new resin using fuel pool water will dilute the SFP, the most recent SFP boron sample must indicate at least a 2100 ppm in the SFP. (Dilution will be approximately 20 ppm with A and B pools connected.)
3. Attachments 1 & 2 have been completed.
4. Sufficient volume is available in the RHT to accommodate rinse water.
5. If SFP B is to be used as rinse water source, then SFP B is aligned for Fuel Pool Cooling.
6. Verify indicated SFP level is greater than 23 feet 10 inches.
7. Radwaste Control Room has been contacted to ensure adequate space is available in Spent Resin Tanks to accommodate sluice.

NOTE: A member of Operations management has determined that the requirements of a ZONE 1 FMEA are not applicable for adding resin.

8. The SFP Cleanup System is classified as a FMEA (Zone 4) cleanliness Class B. The requirements of MMM-011 have been reviewed.

8.11.2 Procedural Steps

1. Shut 1SF-128, Fuel Pool Purify Demin A Inlet Isolation.
2. Shut 1SF-129, Fuel Pool Purify Demin A Outlet Isolation.
3. Inform Radwaste Control Room that Fuel Pool Demineralizer 1&4X is isolated and resin is ready to be removed per OP-120.04, Spent Resin Storage and Transfer System.
4. When resin sluice is complete, as notified by Operator, resin can be loaded into the demineralizer.
5. Verify shut 1SF-130, Fuel Pool Purify Demin A Outlet to FT-5154A.
6. Verify shut 1SF-139, Fuel Pool Purify Demin A Outlet to FT-5154B.
7. Open 1SF-129, Fuel Pool Purify Demin A Outlet Isol.
8. Open 1SF-177, Fuel Pool Demineralizer A Disch Header Drain Isol.

CAUTION

Venting will require more than 5 gallons. Appropriate vent rig should accommodate more than 5 gallons.

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9. Uncap 1SF-171, Fuel Pool Demineralizer A Vent Isolation, and attach a vent rig of the appropriate type as determined by Health Physics.
10. Open 1SF-171, Fuel Pool Demineralizer A Vent Isol.
11. Open 1SF-172, Fuel Pool Demineralizer A Vent Isol.
12. Have Maintenance remove the blank flange from 1SF-173, Fuel Pool Demineralizer A Resin Fill Valve, and attach the resin fill apparatus.
13. Open 1SF-173, Fuel Pool Demineralizer A Resin Fill Valve.
14. Open 1SF-174, Fuel Pool Demin A Resin Fill Vlv.
15. Start filling Fuel Pool Demineralizer 1&4X with appropriate resin.
16. When resin fill is completed, shut the following:
    - 1SF-177, Fuel Pool Demineralizer A Disch Header Drain Isol
    - 1SF-174, Fuel Pool Demin A Resin Fill Vlv.
    - 1SF-173, Fuel Pool Demineralizer A Resin Fill.
17. Have Maintenance install the blind flange on from 1SF-173, Fuel Pool Demineralizer A Resin Fill Valve.
18. Verify shut 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.
19. Open 1SF-126 (1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin A.

CAUTION

- Opening 1SF-128 may gravity fill the Demineralizer. Flow from the vent path should be anticipated while manipulating 1SF-128.
- Communications must be established between the person operating 1SF-201 and the person observing Demineralizer 1&4X-NNS vent flow through 1SF-171 and 1SF-172.

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20. Station an Operator to observe Demineralizer 1&4X-NNS vent flow through 1SF-171 and 1SF-172.
21. Open 1SF-128, Fuel Pool Purif Demin A Isol.

CAUTION

Demineralized Water pressure can exceed the design pressure of the Fuel Pool Purification system. Do not exceed 125 psig on PI-5190A (B) while operating 1SF-201.

22. While monitoring Fuel Pool Purif Pump A(B) Discharge pressure on PI-5190A(B), unlock and slowly throttle open 1SF-201, Demin WT Supply Isol to Fuel Pool Purif, and maintain less than 25 psig on PI-5190A(B) to control the fill rate.
23. When Demineralizer 1&4X-NNS is full, as evidenced by a solid stream of water issuing from the vent (1SF-171 and 1SF-172) shut and lock 1SF-201, Demin WT Supply Isol to Fuel Pool Purif.
24. Shut 1SF-171, Fuel Pool Demineralizer A Vent Isol.
25. Shut 1SF-172, Fuel Pool Demineralizer A Vent Isol.
26. Remove the vent rig from 1SF-171 and replace the cap.
27. Shut 1SF-126 (1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin A.
28. Open 1SF-202, SFP Supply Isol to Fuel Pool Purify Sys.
29. Have the Main Control Room verify that the VCT is not being drained to the RHT.
30. Have Radwaste Control Room verify the following:
    - 3BR-369, RMT Pump 1&2A and 1&2B Disc to RHT Isol (A128B, EL 268) is shut.
    - 3BR-130, Recycle Hold Up Tk 1&2A Nonfiltered Effluent Inlet (A509, EL 242) is locked open.

NOTE: If Fuel Pool Gates #2 and #3 are installed then SFP B level will drop 1 inch for each 841 gal of water used during rinse.

31. Verify indicated SFP B level is greater than 23 feet 10 inches.
32. Isolate all Purification Pump discharge paths by verifying shut the following valves:
    - 1SF-143, Fuel Pool Purif Sys A Supply to Refuel Cav.
    - 1SF-187, Fuel Pool Purif Return to RWST.
    - 1SF-188, Fuel Pool Purif Return Isolation.
    - 1SF-189, Fuel Pool Purif Return to SFP Downstream 1SF-141.
    - 1SF-205, Fuel Pool Purif Ret Isol to Fuel Pools.
33. Verify RCDT Pump Discharge is not aligned to the Fuel Pool Purification System by verifying shut 1SF-194, Reactor Cool Dr Tk Supply to Fuel Pool Purif Sys.
34. Align Purification System Suction Header Flow Path to SFP B by performing the following:
    a. Verify shut 1SF-203, FPP Sys Common Sup Header from Unit 2 and 3 and Cask Pl.

8.11 Fuel Pool Demineralizer Resin Change and Rinse (continued)

b. Verify locked shut 1SF-201, Demin WT Supply Isol to Fuel Pool Purif Sys.

c. Verify shut 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purif Sys Comm.

d. Verify shut 1SF-148, Transfer Canal A Supply Isol to Purif Sys.

e. Verify shut 1SF-193, RWST Supply Isol to Fuel Pool Purif Sys.

f. Verify shut 1SF-120, Unit 1 Refuel Cav to Fuel Pool Purif Pumps 1A & 1B.

g. Verify open 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.

h. Verify open 1SF-149, Fuel Pool Purif Sys Supply Isol.

i. Verify Fuel Pool Cooling is aligned to SFP B.

j. Stop Fuel Pool Cooling Pump A(B), whichever is aligned to SFP B.

k. Open the following applicable valve, whichever is aligned to SFP B:

- 1SF-21, A Train Supply to Purif Sys
- 1SF-20, 1B-SB Fuel Pool Cooling Supply to Purif Sys

l. Open 1SF-22, FPC System Supply Isol to Purif Sys.

35. Notify Radwaste Control Room of the purification system flow path and inform them that they will receive demineralizer rinse water to the RHT.

36. Notify Chemistry of purification system flow path and the need to monitor demineralizer effluent so that the proper sample point may be used to monitor demineralizer rinse water.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 which results in a AEP-1 alarm.

37. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for the Purification Pump A and B to ON.

8.11 Fuel Pool Demineralizer Resin Change and Rinse (continued)

NOTE: The following Steps are written for A Train purification components, with B Train components nomenclature in parentheses.

CAUTION

- Steps 8.11.2.038 through 8.11.2.043 should be performed without delay to minimize the use of the borated water source.
- When transferring water the RHT and Fuel Pool levels should be monitored frequently.
- Chemistry should be notified when changing the purification flow path to ensure proper sample point is being used.
- Chemistry should be prepared to sample demin effluent after initial rinse.

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38. Align Purification discharge path to the RHT by performing the following:
    a. Open 1SF-188, Fuel Pool Purif Return Isolation.

CAUTION

Gravity drain of the SFP to the RHT may occur when 3BR-124, SFPCS Purif Pumps Disc to RHT, and 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin A, are opened.

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    b. Have Radwaste Control Room open 3BR-124, SFPCS Purif Pumps Disc to RHT (A507, EL 243).
    c. Open 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin A.
    d. Slowly open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

39. Notify the Main Control Room of the purification system flow path.

40. If gravity flow is less than 80 gpm, perform the following:
    a. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).
    b. Open 1SF-127 (1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A (1B).
    c. Start Fuel Pool Purification pump A(B) from panel 3SF-SFPC7.
    d. Throttle 1SF-123(1SF-133), Fuel Pool Purif Pump 1A(1B) Disch Isol, as necessary to limit flow to between 80 and 100 gpm to the RHT on FI-5154A(B).
    e. Open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B), and verify that flow remains between 80 and 100 gpm.
    f. Proceed to Step 42.

8.11 Fuel Pool Demineralizer Resin Change and Rinse (continued)

41. If gravity flow is greater than 100 gpm, throttle 1SF-123(1SF-133), Fuel Pool Purif Pump 1A(1B) Disch Isol, as necessary to limit flow to between 80 and 100 gpm to the RHT on FI-5154A(B).

CAUTION

Valve 1SF-127(1SF-137) must be fully shut to ensure flow is directed through the demineralizer.

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42. If open, while maintaining flow between 80 and 100 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A(1B), and note the time of the start of Demineralizer rinse.

43. Rinse demineralizer for approximately 10 minutes and perform the following:

    a. Inform Chemistry to sample demineralizer effluent.

    b. When sample has been taken, stop the purification pump A(B).

    c. Shut 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin A.

    d. Have Radwaste Control Room shut 3BR-124, SFPCS Purif Pumps Disc to RHT.

    e. Inform the Main Control Room the rinse is stopped.

    f. If necessary, fill SFP B until level is greater than 23 feet 10 inches.

44. If Chemistry reports demineralizer effluent is abnormal, return to Step 8.11.2.38 and perform applicable actions.

45. When Chemistry confirms no abnormal release from demineralizer, open both purification pump supply breakers at 1-4A1021-1D and 1-4B1021-5E.

NOTE: After completion of Attachment 23 the Purification System is aligned for normal shutdown.

46. Align the purification system per Attachment 23.

47. If desired to start purification, proceed to Section 5.2.

8.12 Filling the Fuel Transfer Canals and Cask Loading Pool

8.12.1 Initial Conditions

1. Attachments 1 and 2 are completed.
2. Fuel Pool Cooling System Train A is not in service.

8.12.2 Procedural Steps

NOTE:
- If the Main Fuel Transfer Canal is to be filled then the Fuel Pool Gate #1, between the Unit 1 Fuel Transfer Canal and the Main Fuel Transfer Canal must be removed.
- If the Cask Loading Pool is to be filled then the Fuel Pool Gates #1, #5 and #8 between the Main Fuel Transfer Canal and the Cask Loading Pool must be removed also.
- If the Cask Loading Pool is to be filled with the Main Fuel Transfer Canal left dry, Section 8.4 should be used to fill the Pool.

1. Verify shut 1SF-193, RWST Supply Isol to Fuel Pool Purif Sys.
2. Ensure Fuel Pool Cooling Pump A is stopped then shut 1SF-1, Unit 1 SFP Supply to A Train Isolation.
3. Shut 1SF-5, Fuel Pool Hx 1&4A-SA Inlet Isol.
4. Verify shut 1SF-25, 1B-SB FPC Supply to Transfer Canal.
5. Verify shut 1SF-21, A Train Supply to Purif Sys.
6. Throttle 1SF-24, A Train Supply to XFER Canal Isol, 40% to 60% open.
7. Open 1SF-23, FPC Sys Supply Fill Isol to Transfer Canal U-1&4.
8. Verify shut 3BR-378, REFP disc to Units 1&4 SPFCS XFER Canal.
9. Verify shut 1SF-9, NFP to A Train Supply Isolation.
10. Open 1SF-10, RWST to A Supply Isolation.

NOTE: When 1CT-23 is opened there may be flow to the Unit 1 Fuel Transfer Canal depending on RWST Level.

CAUTION

Opening 1CT-23 makes the RWST inoperable, due to purification lines not being seismically qualified. This is a one hour action in Modes 1 - 4.

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11. Open 1CT-23, RWST to SFP Pump Suction.

NOTE: Communications must be established between the Operator at AEP-1 and the Operator in the Fuel Handling Building observing canal fill.

CAUTION

1SF-24, A Train Supply to XFER Canal Isol, must be throttled to maintain Fuel Pool Cooling Pump differential pressure above 43 psid, to prevent pump run out. This can be accomplished by ensuring pump discharge pressure as read on PI-5130 A is greater than 56 psig.

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12. At AEP-1, start Fuel Pool Cooling Pump A.

8.12 Filling the Fuel Transfer Canals and Cask Loading Pool (continued)

13. Throttle 1SF-24, A Train Supply to Xfer Canal Isol, to maintain pump discharge pressure on PI-5130 A greater than 56 psig.

14. When the desired level is reached in the Unit 1 Fuel Transfer Canal (and Main Fuel Transfer Canal and Cask Loading Pool if they are being filled) perform the following Steps:

    a. At AEP-1, Stop Fuel Pool Cooling Pump A.

NOTE: Shutting 1CT-23 will restore the RWST to operable.

    b. Shut 1CT-23, RWST to SFP Pump Suction, and document valve position per OMM-001 and PLP-702.

    c. Shut 1SF-10, RWST to A Supply Isolation.

    d. Shut 1SF-23, FPC Sys Supply Fill Isol to Transfer Canal U-1&4.

    e. Shut 1SF-24, A Train Supply to XFER Canal Isol.

    f. Open 1SF-5, Fuel Pool Hx 1&4A-SA Inlet Isol.

    g. Open 1SF-1, SFP Supply to A Train Isolation.

15. Complete applicable portions of Attachment 16.

8.13 Emergency Makeup to Fuel Pools from ESW

8.13.1 Initial Conditions

NOTE: This Section provides emergency makeup water to both NFP A and SFP B with gates #3 and #4 removed.

1. RWST is not available for Fuel Pool makeup.
2. Demineralized Water is not available for Fuel Pool makeup.
3. Fuel Pool Cooling shutdown per Section 7.1.

NOTE: The gang box located in the 236 RAB at the entrance to the 216 Pipe Tunnel area should contain all necessary hoses and couplings.

CAUTION

A backflow preventer should be used to prevent possible contamination to the ESW System.

---

4. Approximately 50 feet of 1 inch rubber hose and 1 inch threaded couplings have been obtained to be used as a jumper between two vent lines.

NOTE: Since the ESW System uses raw water with high chloride content, it should only be used in an extreme emergency.

8.13.2 Procedural Steps

1. Verify shut 1CT-23, RWST to SFP Pump Suction.

NOTE: If Train B of ESW is out of service, the connection at 1SW-269 (located on Diesel Generator 1A ESW return line in 236 RAB) may be used instead of the connection at valve 1SW-1239.

2. Connect jumper between Designated SFPCCS Emerg Makeup Conn Vent Vlv, 1SF-76 (located downstream of 1CT-23) and valve 1SW-1239 (located on Diesel Generator 1B ESW return line in 236 RAB).
3. Open 1SF-10, RWST to A Supply Isolation.

NOTE: B Train (A Train) ESW will be inoperable whenever 1SW-1239 (1SW-269) is opened.

4. While closely monitoring fuel pool levels, open the following valves:
   a. 1SW-1239, DG 1B SW Return Hdr SFCW Emerg M/U Conn, or 1SW-269, DG 1A SW Return Hdr SFCW Emerg M/U Backup Conn

      and

   b. 1SF-76, SFPCCS Emerg Makeup Conn Vent Vlv
5. When desired level is being maintained in the Fuel Pools, shut 1SF-76 and 1SW-1239(or 1SW-269).
6. Shut 1SF-10, RWST to A Supply Isolation.
7. Complete Attachment 17.

8.14 Recirculation of the Unit 1 Fuel Pools and Transfer Canal Using Spent Fuel Pool Cooling Pump

8.14.1 Initial Conditions

1. Attachment 1 has been completed.
2. Attachment 2 has been completed.
3. System filled and vented per Section 8.1.
4. SFP B and NFP A are filled.
5. Unit 1 Fuel Transfer Canal filled.
6. Gates #3 and #4 removed from SFP B and NFP A.
7. Fuel Pool Purification has been secured from the Unit 1 Fuel Pools and Transfer Canal per Section 7.2.

8.14.2 Procedural Steps

NOTE: The following Steps lineup Train A Fuel Pool Cooling Pump components, with Train B component nomenclature in the parentheses.

1. To recirc SFP B and Fuel Transfer Canal:
   a. Verify open 1SF-1(1SF-11), SFP Supply to A(B) Train Isolation.
   b. Verify shut 1SF-9(1SF-19), NFP to A(B) Train Supply Isolation.
2. To recirc NFP A and the Fuel Transfer Canal:
   a. Verify open 1SF-9(1SF-19), NFP to A(B) Train Supply Isolation.
   b. Verify shut 1SF-1(1SF-11), SFP Supply to A(B) Train Supply Isolation.
3. Shut 1SF-5(1SF-15), Fuel Pool 1&4A-SA(1&4B-SB) Heat Exchanger Inlet Isol.
4. Open 1SF-24, A Train Supply to Transfer Canal Isol, or (1SF-25) 1B-SB FPC Supply to Transfer Canal.
5. Verify open 1SF-2, FPC Pump 1&4A-SA Suction Isolation or (1SF-12), 1&4B-SB Fuel Pool Cooling Pump Suction Isolation.

CAUTION

FPC Sys Supply Fill Isol to Transfer Canal U-1&4, 1SF-23, must be throttled to maintain Fuel Pool Cooling Pump differential pressure above 43 psid to prevent pump run out. This can be accomplished by ensuring pump discharge pressure as read on PI-5130 A(B) is greater than 56 psig.

---

6. Throttle open 1SF-23, FPC Sys Supply Fill Isol to Transfer Canal U-1&4 to 40% to 50% open.
7. At AEP-1, Start Fuel Pool Cooling Pump A(B).
8. Verify 1SF-23, FPC Sys Supply Fill Isol to Transfer Canal U-1&4, is throttled to maintain at least 56 psig on PI-5130 A(B).
9. Complete applicable portions of Attachment 18.
10. When recirculation on SFP B and Fuel Transfer Canal is no longer desired, at AEP-1, secure Fuel Pool Cooling Pump A(B).

8.14 <u>Recirculation of the Unit 1 Fuel Pools and Transfer Canal Using Spent Fuel Pool Cooling Pump</u> (continued)

11. Shut 1SF-23, FPC Sys Supply Fill Isol to Transfer Canal U-1&4.

12. Shut 1SF-24, A Train Supply to Transfer Canal Isol, or (1SF-25) 1B-SB FPC Supply to Transfer Canal.

13. Open 1SF-5(1SF-15), Fuel Pool 1&4A-SA(1&4B-SB) Heat Exchanger Inlet Isol.

14. Complete applicable portions of Attachment 18.

8.15 Aligning Fuel Pool Cooling and Cleanup System for Mode 6 to Prevent Inadvertent Dilution During Refueling

8.15.1 Initial Conditions

1. The plant is in MODE 5, preparing to go to MODE 6 per GP-009.

8.15.2 Procedural Steps

1. When directed by GP-009, perform Attachment 19.

8.16 Swapping Fuel Pool Purification System Trains

8.16.1 Initial Conditions

1. Fuel Pool Purification System is in service per Section 5.2.

NOTE:
- The Fuel Pools and Refueling Water Purification Pump A(B) can only be stopped from the panel that it was started. The amber light will be lit at the control switch which is deactivated.
- The following Steps swap from Fuel Pool Purification System Train A to Train B. Nomenclature for swapping from Train B to Train A is in parentheses.

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

8.16.2 Procedural Steps

1. At panel 3SF-SFPC7 or 3SF-SFPC9, stop Fuel Pools and Refueling Water Purification Pump A(B).
2. Verify open 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1B.
3. Verify open 1SF-127, Fuel Pool Purif Demin A Bypass From Pump 1A.
4. Verify shut 1SF-126, Fuel Pool Purif Filter 1A Supply to Demin.
5. Verify shut 1SF-136, Fuel Pool Purif Filter 1B Supply to Demin A.
6. Verify shut 1SF-130, Fuel Pool Demin A Outlet to FT-5154A.
7. Verify shut 1SF-139, Fuel Pool Purif Demin A Outlet to FT-5154B.
8. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump B(A).

NOTE: Communications must be established between SFP Purification Pump Discharge Valve (216 FHB) and flow instruments on panel 3SF-SFPC7 (236 FHB).

CAUTION

Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the F-P7 alarm (FUEL POOLS FLTR 1 & 4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1 & 4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the demineralizer.

---

9. Monitor flow on FI-5154B(A) and throttle Fuel Pool Purif Pump 1B(1A) Disch Isol, 1SF-133(1SF-123) as necessary to limit flow between 230 and 260 gpm.
10. On the running SFP Purification Pump, slowly open 1SF-136(1SF-126), Fuel Pool Purif Filter 1B(1A) Supply to Demin.

8.16 Swapping Fuel Pool Purification System Trains (continued)

11. Open 1SF-139(1SF-130), Fuel Pool Purif Demin A Outlet to FT-5154B(A) for the running pump, and verify total flow on FI-5154 B(A) remains less than 260 gpm, but greater than 230 gpm.

12. While verifying flow on FI-5154 B(A) remains less than 260 gpm, slowly shut 1SF-137(1SF-127), Fuel Pool Purif Demin A Bypass From Pump 1B(1A) for the running pump.

13. Complete Attachment 8, Section G. Sections not used may be marked N/A.

14. Complete Attachment 5.

8.17 Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Discharging to SFP B

8.17.1 Initial Conditions

1. Attachment 1 is complete.
2. Attachment 2 is complete.

CAUTION

- Only one train can be aligned to the demineralizer due to the 260 gpm flow indication.
- Do not line up more than one pool at a time for purification operation, unless these pools are connected by removal of pool gates and water level established between connection canals.

---

3. Pool Gates #2, #5, and #8, or #3, #1, #5 and #8 are removed between the Cask Loading Pool and SFP B to allow these pools to be connected.
4. Facilities Maintenance has removed any plugs from the desired suction path.
5. Fuel Pool Cooling system is aligned to SFP B per Section 5.1.
6. Fuel Pool Purification System is shutdown per Section 7.2.
7. System has been filled and vented per Section 8.2.

8.17.2 Procedural Steps

NOTE: The following Steps line up Fuel Pool and Refueling Water Purification Pump A to SFP B, with Fuel Pool and Refueling Water Purification Pump B component nomenclature in parentheses.

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. To provide suction from the Cask Loading Pool and Unit 2 Fuel Transfer canal, perform the following:
   a. Open 2SF-199, Cask Loading Pools to Fuel Pool Purif Suct.
   b. Open 2SF-200, Cask Loading Pool to Fuel Pool Purif Suction.
   c. Open 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask PL.
   d. Open 2SF-146, Unit 2 Fuel Xfer Canal East Drain to Purification System.
   e. Open 2SF-147, Unit 2 Fuel Xfer Canal West Drain to Purification System.
   f. Open 2SF-148, Unit 2&3 Supply Isol to Fuel Pool Purif Sys A.

8.17 Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Discharging to SFP B (continued)

2. Open 1SF-29, FP Purif Sys Return Isol to A FPC to SFP to provide discharge path to SFP B.

NOTE: Both bypass valves are opened in Step 8.17.2.03 so that the non running pump has a flow path in case of an inadvertent pump start.

3. Open 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

4. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for Fuel Pool and Refueling Water Purification Pump A and B to ON.

NOTE: Communications must be established between Purification Pump Discharge Valve (216 FHB) and flow instruments on panel 3SF-SFPC7 (236 FHB).

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarm (FUEL POOLS FLTR 1 & 4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1 & 4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

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5. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).
6. Monitor flow on FI-5154A(B) and throttle Fuel Pool Purif Pump 1A(1B) Disch Isol 1SF-123(1SF-133) as necessary to limit flow between 230 and 260 gpm.
7. Open 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.
8. Open 1SF-130(1SF-139), Fuel Pool Purif Demin A Outlet to FT-5154A(B) for the running pump, and verify total flow on FI-5154 A(B) remains between 230 and 260 gpm.
9. While verifying flow on FI-5154 A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A(1B), for the running pump.
10. Complete Attachment 5.
11. Complete Attachment 20.
12. When Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification is complete proceed with the next Step.

8.17 Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Discharging to SFP B (continued)

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

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13. At panel 3SF-SFPC7 or 3SF-SFPC9, stop the running Fuel Pool and Refueling Water Purification Pump.
14. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for Fuel Pool and Refueling Water Purification Pump to OFF.
15. Perform the following valve lineup to secure the Fuel Pool and Refueling Water Purification System.
    a. Shut 2SF-199, Cask Loading Pools to Fuel Pool Purif Suct.
    b. Shut 2SF-200, Cask Loading Pool to Fuel Pool Purif Suction.
    c. Shut 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask PL.
    d. Shut 2SF-146, Unit 2 Fuel Xfer Canal East Drain to Purification System.
    e. Shut 2SF-147, Unit 2 Fuel Xfer Canal West Drain to Purification System.
    f. Shut 2SF-148, Unit 2&3 Supply Isol to Fuel Pool Purif Sys A.
    g. Shut 1SF-29, FP Purif Sys Return Isol to A FPC to SFP.
16. Complete Attachment 8, Sections G and H. Sections not used may be marked N/A.
17. Complete Attachment 5.
18. Direct Facilities Maintenance to reinstall any plugs removed in Step 8.17.1.04.

8.18 Main Fuel Transfer Canal Purification Discharging to SFP B

NOTE: This Section may be used in conjunction with Section 8.17 but the flow rate will be reduced at each drain point.

8.18.1 Initial Conditions

1. Attachment 1 is complete.
2. Attachment 2 is completed.

CAUTION

- Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.
- Do NOT line up more than one pool at a time for purification operation, unless these pools are connected by removal of pool gates and water level established between connection canals.

---

3. Fuel Pool Gate(s) #2, or (#3 and #1), is/are removed between the Main Transfer Canal and SFP B to allow these pools to be connected.
4. The Fuel Pool Purification System has been filled and vented.
5. Facilities Maintenance has removed any plugs from the desired suction path.
6. Fuel Pool Cooling system is aligned to SFP B per Section 5.1.
7. Fuel Pool Purification System is shutdown per Section 7.2.

8.18.2 Procedural Steps

NOTE: The following Steps line up Fuel Pool and Refueling Water Purification Pump A to SFP B, Fuel Pool and Refueling Water Purification Pump B component nomenclature in parentheses.

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. Provide a suction from the Main Fuel Transfer Canal by performing the following:
   a. Open 1SF-196, Fuel Xfer Canal NW Supply Isol to Fuel Pool Purif.
   b. Open 1SF-197, Fuel Xfer Canal N Supply Isol to Fuel Pool Purif.
   c. Open 1SF-198, Fuel Xfer Canal NE Supply Isol to Fuel Pool Purif.
   d. Open 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purif Sys Comm.

8.18 Main Fuel Transfer Canal Purification Discharging to SFP B (continued)

2. Open 1SF-29, FP Purif Sys Return Isol to A FPC to SFP to provide a discharge path to SFP B.

NOTE: Both bypass valves are opened in Step 8.18.2.03 so that the non-running pump has a flow path in case of an inadvertent pump start.

3. Open 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B, respectively.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

4. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for Fuel Pool and Refueling Water Purification Pump A and B to ON.

NOTE: Communications must be established between Purification Pump Discharge Valve (216 FHB) and flow instruments on panel 3SF-SFPC7 (236 FHB).

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarm (FUEL POOLS FLTR 1 & 4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1 & 4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

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5. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).

6. Monitor flow on FI-5154A(B) and throttle Fuel Pool Purif Pump 1A(1B) Disch Isol, 1SF-123(1SF-133) as necessary to limit flow between 230 and 260 gpm.

7. Open 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.

8. Open 1SF-130(1SF-139), Fuel Pool Purif Demin A Outlet to FT-5154A(B), and verify total flow on FI-5154 A(B) remains between 230 gpm and 260 gpm.

9. While verifying flow on FI-5154 A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A(1B).

10. Complete Attachment 5.

11. Complete applicable portions of Attachment 21.

12. When Main Fuel Transfer Canal Purification is complete proceed with the next Step.

8.18 Main Fuel Transfer Canal Purification Discharging to SFP B (continued)

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

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13. At panel 3SF-SFPC7 or 3SF-SFPC9, stop the running Fuel Pool and Refueling Water Purification Pump.
14. At 1-4A1021-1D and 1-4B1021-5E, turn the breaker for Fuel Pool and Refueling Water Purification Pump A and B to OFF.
15. Perform the following valve lineup to secure the Fuel Pool and Refueling Water Purification system.
    a. Shut 1SF-196, Fuel Xfer Canal NW Supply Isol to Fuel Pool Purif.
    b. Shut 1SF-197, Fuel Xfer Canal N Supply Isol to Fuel Pool Purif.
    c. Shut 1SF-198, Fuel Xfer Canal NE Supply Isol to Fuel Pool Purif.
    d. Shut 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purif Sys Comm.
    e. Shut 1SF-29, FP Purif Sys Return Isol to A FPC to SFP.
16. Complete Attachment 8, Sections D and G. Sections not used may be marked N/A.
17. Complete Attachment 5.
18. Direct Facilities Maintenance to reinstall any plugs removed in Step 8.18.1.05.

8.19 Recirculation of SFP B and the Fuel Transfer Canal Using Spent Fuel Purification System

8.19.1 Initial Conditions

1. Attachments 1 and 2 are complete.
2. System filled and vented per Sections 8.1 and 8.2.
3. SFP B filled.
4. Unit 1 Fuel Transfer Canal filled.
5. Gate #3 removed from SFP B.

8.19.2 Procedural Steps

1. Secure Spent Fuel Pool Purification per Section 7.2.
2. Perform the following valve lineup:
   a. Open 1SF-146, Unit 1 Fuel Transfer Canal East Drain Isol.
   b. Open 1SF-147, Unit 1 Fuel Transfer Canal West Drain Isol.
   c. Open 1SF-148, Transfer Canal A Supply Isol to Purification System.

NOTE:
- Communications must be established between Purification Pump Discharge Valve (216 FHB) and flow instruments on panel 3SF-SFPC7 (236 FHB).
- The following Steps start up Fuel Pool Purification System Train A, with Train B component nomenclature in parentheses.
- Both bypass valves are opened in Step 8.19.2.03 in case of an inadvertent pump start.

CAUTION

- Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.
- Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

3. Open 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B.
4. Open 1SF-29(1SF-28), FP Purif Sys Ret Isol to A(B) FPC to Spent Fuel Pools.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

5. At 1-4A1021-1D and 1-4B1021-5E, turn the breakers for Fuel Pool and Refueling Water Purification Pumps A and B to ON.

8.19 Recirculation of SFP B and the Fuel Transfer Canal Using Spent Fuel Purification System (continued)

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarm (FUEL POOLS FLTR 1 & 4A OUTLET FLOW LO or alarm FUEL POOLS FLTR 1 & 4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

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6. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).
7. Monitor flow on FI-5154A(B) and throttle Fuel Pool Purif Pump 1A(1B) Disch Isol, 1SF-123(1SF-133) as necessary to limit flow between 230 and 260 gpm.
8. Open 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin, for the running pump.
9. Open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B), and verify total flow on FI-5154 A(B) remains between 230 gpm and 260 gpm.
10. While verifying flow on FI-5154 A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A(1B).
11. Complete Attachment 5.
12. Complete applicable portions of Attachment 22.

NOTE: The following Steps shutdown Fuel Pool Purification System Train A, with Train B component nomenclature in parentheses.

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

13. At panel 3SF-SFPC7 or 3SF-SFPC9, stop Fuel Pool and Refueling Water Purification Pump A(B).
14. At 1-4A1021-1D and 1-4B1021-5E, turn the breakers for Fuel Pool and Refueling Water Purification Pump A and B to OFF.

8.19 Recirculation of SFP B and the Fuel Transfer Canal Using Spent Fuel Purification System (continued)

15. Perform the following:

    a. Shut 1SF-146, Unit 1 Fuel Transfer Canal East Drain Isolation.

    b. Shut 1SF-147, Unit 1 Fuel Transfer Canal West Drain Isolation.

    c. Shut 1SF-148, Transfer Canal A Supply Isolation to Purification System.

16. Shut 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B).

17. Shut 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.

18. Shut 1SF-29(1SF-28), FP Purif Sys Ret Isol to A(B) FPC to Spent Fuel Pools.

19. Complete Attachment 5.

20. Complete Attachment 8, Sections C and G. Other Sections may be marked N/A.

21. Complete applicable portions of Attachment 22.

8.20 Transfer Water from the Unit 1 Fuel Transfer Canal to Refueling Cavity

8.20.1 Initial Conditions

1. Attachment 1 and 2 are completed.
2. Refueling Coordinator and Superintendent - Shift Operations have instructed that transfer of water to the Refueling Cavity is required, per GP-009.
3. The gates #3, #4, and gate #2 or #1, between the Fuel Pools, or any area that has spent fuel in it, and the Unit 1 Fuel Transfer Canal should be installed with seals pressurized.
4. Fuel Pool Purification System is filled and vented with borated water of at least the same concentration as the Refueling Cavity, if the Refueling Cavity contains borated water.
5. 1SF-201, Demin Water Supply Isol to Fuel Pool Purif, has been verified locked shut.
6. Fuel Pool Purification System is secured.
7. The Transfer Canal gate isolation valve cannot be opened due to a high Δp across the valve.
8. Health Physics has been informed concerning the transfer.

8.20.2 Procedural Steps

NOTE: 1SF-144 and 1SF-145 are locked Reactor Containment Isolation Valves. Tech Spec 3.6.1.1 should be referenced before opening these valves.

CAUTION

Chemistry should be notified when changing the purification flow path to ensure a proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

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1. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.
2. Shut 1SF-191, Fuel Pool Purif Return to SFP Dnstream 1SF-205.
3. Verify shut 1SF-186, Refueling Cavity Drain Isol to Cont Floor.

CAUTION

Continuous Surveillance of the Refueling Cavity and the Unit 1 Fuel Transfer Canal Levels should be performed during the transfer of water.

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4. Open 1SF-145, Refuel Cavity Purification Discharge CIV (IRC).
5. Open 1SF-144, Refueling Cavity Purification Discharge CIV(ORC).
6. Open 1SF-210, Unit 1 Refuel Cavity Purification Return.
7. Open 1SF-146, Unit 1 Fuel Transfer Canal East Drain Isol.
8. Open 1SF-147, Unit 1 Fuel Transfer Canal West Drain Isol.
9. Open 1SF-148, Transfer Canal A Supply Isol to Purification System.
10. Open 1SF-143, Fuel Pool Purif Sys A Supply to Refuel Cav.

8.20 Transfer Water from the Unit 1 Fuel Transfer Canal to Refueling Cavity (continued)

NOTE:
- The following Steps line up Fuel Pool and Refueling Water Purification Pump A to the Refueling Cavity, with Pump B component nomenclature in parentheses.
- Communications must be established between Purification Pump Discharge Valve (216 FHB), Containment 286 elev, FHB 286 elev, and flow instruments on panel 3SF-SFPC7 (236 FHB).
- Both bypass valves are opened in Step 8.20.2.011 in case of an inadvertent pump start.

CAUTION

Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.

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11. Open 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B, respectively.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

12. At 1-4A1021-1D and 1-4B1021-5E, turn the supply breaker for Fuel Pools and Refueling Water Purification Pump A and B to ON.

CAUTION

If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

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13. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).

CAUTION

Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarms (FUEL POOLS FLTR 1&4A OUTLET FLOW LO and alarm FUEL POOLS FLTR 1&4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

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14. Monitor flow on FI-5154A(B), and throttle Fuel Pool Purif Pump 1A(1B) Disch Isol, 1SF-123(1SF-133) as necessary to limit flow to 260 gpm, but greater than 230 gpm.
15. Open 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.
16. Open 1SF-130(1SF-139), Fuel Pool Purify Demin A Outlet to FT-5154A(B), and verify total flow on FI-5154A(B) remains less than 260 gpm.

8.20 Transfer Water from the Unit 1 Fuel Transfer Canal to Refueling Cavity (continued)

17. While verifying flow on FI-5154A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A(1B), for the running pump.

18. Complete Attachment 5.

NOTE: If at any time the Transfer Canal gate isolation valve can be opened, the following Steps should be performed.

19. When the Refueling Coordinator or Superintendent - Shift Operations determines that transfer from the Unit 1 Fuel Transfer Canal to the Refueling Cavity is no longer required, perform the following Steps:

NOTE: If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 (3SF-SFPC9) it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

a. Stop Fuel Pool and Refueling Water Purification Pump A(B), and turn both pumps supply breakers off.

b. Lock shut 1SF-145, Refuel Cavity Purification Discharge CIV (IRC).

c. Lock shut 1SF-144, Refueling Cavity Purification Discharge CIV(ORC).

d. Shut 1SF-210, Unit 1 Refuel Cavity Purification Return.

e. Shut 1SF-143, Fuel Pool Purif Sys A Supply to Refuel Cav.

f. Shut 1SF-146, Unit 1 Fuel Transfer Canal East Drain Isolation.

g. Shut 1SF-147, Unit 1 Fuel Transfer Canal West Drain Isolation.

h. Shut 1SF-148, Transfer Canal A Supply Isolation to Purification System.

i. Open 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.

j. Open 1SF-191, Fuel Pool Purif Return to SFP Dnstream 1SF-205.

k. Shut 1SF-130(1SF-139), Fuel Pool Purif Demin A Outlet to FT-5154A(B).

l. Shut 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) supply to Demin.

m. Verify shut 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B, respectively.

20. Complete Attachment 8, Sections F, G and I. Sections not used may be marked N/A.

21. Complete Attachment 5.

8.21 Transfer Water from the Refueling Cavity to the Unit 1 Fuel Transfer Canal

8.21.1 Initial Conditions

1. Attachments 1 and 2 are completed.
2. Refueling Coordinator or Superintendent - Shift Operations has instructed that Transfer of Water to the Unit 1 Fuel Transfer Canal is required, per GP-009.
3. The water in the Refueling Cavity has a boron concentration of at least the same concentration as the concentration in the Unit 1 Fuel Transfer Canal.
4. 1SF-201, Demin Water Supply Isol to Fuel Pool Purif Sys, has been verified locked shut.
5. Fuel Pool Purification System is secured.
6. The Transfer Canal gate isolation valve is shut.
7. Health Physics has been informed concerning the transfer.
8. The Fuel Pool Purification has been filled and vented.

8.21.2 Procedure Steps

NOTE: 1SF-118 and 1SF-119 are locked Reactor Containment Isolation Valves. Tech Spec 3.6.1.1 should be referenced before opening these valves.

CAUTION

- Continuous surveillance of the Refueling Cavity and the Unit 1 Fuel Transfer Canal levels should be performed during the transfer of water.
- Chemistry should be notified when changing the purification flow path to ensure proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

1. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.
2. Shut 1SF-191, Fuel Pool Purif Return to SFP Dnstream 1SF-205.
3. Open 1SF-118, Refuel Cavity Purification Suct CIV (IRC).
4. Open 1SF-119, Refuel Cavity Purification Suction CIV (ORC).
5. Open 1SF-212, Unit 1 Refuel Cav Purif Suct Isol.
6. Open 1SF-120, Unit 1 Refuel Cavity to Fuel Pool Purification Pumps 1A and 1B.
7. Open 1SF-192, Fuel Pool Purification System Return to Transfer Canal A.

8.21 Transfer Water from the Refueling Cavity to the Unit 1 Fuel Transfer Canal (continued)

NOTE:
- The following Steps line up Fuel Pool and Refueling Water Purification Pump A to the Unit 1 Fuel Transfer Canal, with Pump B component nomenclature in parentheses.
- Communications must be established between Purification Pump Discharge Valve (216 FHB), Containment 286 elev, and flow instruments on panel 3SF-SFPC7 (236 FHB).
- Both bypass valves are opened in Step 8.21.2.08 in case of an inadvertent pump start.

CAUTION

Only one train can be aligned to the demineralizer due to the 260 gpm flow limitation.

---

8. Open 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B.

NOTE: Both breakers are turned ON to prevent a continuous alarm from being locked in on 3SF-SFPC9 that results in an ALB-23 alarm.

9. At 1-4A1021-1D and 1-4B1021-5E, turn the supply breaker for Fuel Pools and Refueling Water Purification Pumps A and B to ON.

NOTE: Drain points should be monitored closely to ensure the Purification pumps maintain adequate suction pressure to prevent pump cavitation.

CAUTION

- If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 or 3SF-SFPC9 it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.
- Fuel Pool Demineralizer flow must be greater than 230 gpm to clear the 3SF-SFPC7 alarms (FUEL POOLS FLTR 1&4A OUTLET FLOW LO and alarm FUEL POOLS FLTR 1&4B OUTLET FLOW LO), and less than 260 gpm to prevent exceeding continuous flow limits of the Demineralizer.

---

10. At panel 3SF-SFPC7 or 3SF-SFPC9, start Fuel Pool and Refueling Water Purification Pump A(B).

11. Monitor flow on FI-5154A(B), and throttle Fuel Pool Purif Pump 1A(1B) Disch Isol, 1SF-123(1SF-133) as necessary to control flow to between 230 gpm and 260 gpm.

12. Open 1SF-126(1SF-136), FP Purif Fltr 1A(1B) Supply to Demin.

13. Open 1SF-130(1SF-139), Fuel Pool Purif Demin A Outlet to FT-5154A(B), and verify total flow on FI-5154A(B) remains less than 260 gpm.

14. While verifying flow on FI-5154A(B) remains less than 260 gpm, slowly shut 1SF-127(1SF-137), Fuel Pool Purif Demin A Bypass From Pump 1A(1B).

8.21 Transfer Water from the Refueling Cavity to the Unit 1 Fuel Transfer Canal (continued)

15. Complete Attachment 5.

16. When the Refueling Coordinator or Superintendent - Shift Operations determines that transfer from the Refueling Cavity to the Unit 1 Fuel Transfer Canal is no longer required, perform the following Steps:

NOTE: If the Fuel Pool and Refueling Water Purification Pump or Fuel Pool Skimmer Pump is started from panel 3SF-SFPC7 (3SF-SFPC9) it can only be stopped from the same panel. The amber light will be lit on the panel that the pump was not started from.

a. Stop Fuel Pool and Refueling Water Purification Pump A(B), and turn both power supply breakers OFF.

b. Lock shut 1SF-118, Refuel Cavity Purification Suct CIV (IRC).

c. Lock shut 1SF-119, Refuel Cavity Purification Suction CIV (ORC).

d. Shut 1SF-212, Unit 1 Refuel Cav Purif Suct Isol.

e. Shut 1SF-120, Unit 1 Refuel Cavity to Fuel Pool Purification Pumps 1A & 1B.

f. Shut 1SF-192, Fuel Pool Purification System Return to Transfer Canal A.

g. Open 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.

h. Open 1SF-191, Fuel Pool Purif Return to SFP Dnstream 1SF-205.

i. Shut 1SF-130(1SF-139), Fuel Pool Purif Demin A to FT-5154A(B).

j. Shut 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.

k. Verify shut 1SF-127 and 1SF-137, Fuel Pool Purif Demin A Bypass From Pump 1A and 1B.

17. Complete Attachment 8, Sections F, G, and J. Sections not used may be marked N/A.

18. Complete Attachment 5.

8.22 Transfer of Water from the RCDT Via the Fuel Pool Purification System to the RWST or Fuel Pools or Transfer Canal

8.22.1 Initial Conditions

1. Attachments 1 and 2 are completed.
2. Radwaste Control Room and Operations have coordinated the transfer per OP-120.08.
3. If water is being transferred to the refueling cavity, the boron concentration of water to be transferred is within the limits of the COLR or greater than 2400 ppm.
4. The Fuel Pool Purification System has been shut down per Attachment 8.
5. If water is being transferred to the RWST, Attachment 26 has been performed such that when transfer is complete, the RWST boron concentration will be greater than or equal to 2400 ppm.

8.22.2 Procedure Steps

CAUTION

Chemistry should be notified when changing the purification flow path to ensure proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

---

1. Shut 1SF-202, SFP Supply Isol To Fuel Pool Purif Sys.
2. Shut 1SF-191, Fuel Pool Purif Return To SFP Dnstream 1SF-205.
3. Open 1SF-194, Reactor Cool Dr Tk Supply To Fuel Pool Purif Sys.

NOTE: Radwaste Control Room will be pumping approximately 100 gpm through the Fuel Pool Demineralizer.

4. Open 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.
5. Open 1SF-130(1SF-139), Fuel Pool Purif Demin A Outlet to FT-5154A(B).
6. Open the desired valve(s) to send water to:
   a. RWST: 1SF-187, Fuel Pool Purif Return to RWST
   b. NFP A:
      (1) 1SF-189, Fuel Pool Purif Return to SFP Downstream 1SF-141

      AND

      (2) 1SF-26(1SF-27), FP Purif Sys Return Isol To A(B) FPC To NFP.
   c. SFP B:
      (1) 1SF-189, Fuel Pool Purif Return to SFP Downstream 1SF-141

      AND

      (2) 1SF-29(1SF-28), FP Purif Sys Ret Isol to A(B) FPC to Spent Fuel Pools.

8.22 <u>Transfer of Water from the RCDT Via the Fuel Pool Purification System to the RWST or Fuel Pools or Transfer Canal</u> (continued)

d. 1&4 Transfer Canal 1SF-192, Fuel Pool Purif Sys Return to Xfer Canal A.

7. Notify Radwaste Control Room the lineup is complete and to start the RCDT Pump.

8. Complete Attachment 5.

9. When at desired level, have Radwaste Control Room secure the RCDT pump.

10. When transfer is complete:

    a. Shut 1SF-187, Fuel Pool Purif Return to RWST

    OR

    b. NFP A:

        (1) Shut 1SF-189, Fuel Pool Purif Return to SFP Downstream 1SF-141

        AND

        (2) Shut 1SF-26(1SF-27), FP Purif Sys Return Isol To A(B) FPC To NFP.

    c. SFP B:

        (1) Shut 1SF-189, Fuel Pool Purif Return to SFP Downstream 1SF-141

        AND

        (2) Shut 1SF-29(1SF-28), FP Purif Sys Ret Isol to A(B) FPC to Spent Fuel Pools.

    d. Shut 1SF-192, Fuel Pool Purif Sys Return to Xfer Canal A.

    e. Shut 1SF-130(1SF-139), Fuel Pool Purif Demin A Outlet to FT-5154 A(B).

    f. Shut 1SF-126(1SF-136), Fuel Pool Purif Filter 1A(1B) Supply to Demin.

    g. Shut 1SF-194, Reactor Cool Dr Tk Supply To Fuel Pool Purif Sys.

    h. Open 1SF-191, Fuel Pool Purif Return to SFP Dnstream 1SF-205.

    i. Open 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.

    j. Complete Attachment 8, Section K. Sections not used may be marked N/A.

11. Complete Attachment 5.

12. If water was transferred to the RWST, perform Section 8.9, RWST Purification, and sample to verify boron concentration.

8.23 Gravity Fill of Refueling Cavity From Unit 1 Fuel Transfer Canal

8.23.1 Initial Conditions

1. Attachment 1 and 2 are completed.
2. Refueling Coordinator or Superintendent - Shift Operations has instructed that Transfer of Water to the Refueling Cavity is required.
3. The gates #3, #4, and (#2 or #1) between SFP B, NFP A, or any area that has spent fuel in it, and the Unit 1 Fuel Transfer Canal shall be installed with seals pressurized.
4. The Fuel Pool Purification System is filled and vented with borated water greater than or equal to the concentration of the Refueling Cavity, if the Refueling Cavity contains borated water.
5. Fuel Pool Purification System is secured from previous running Section of this procedure per Section 7.2 or per one of the Infrequent Operation Sections.
6. The Transfer Canal gate isolation valve cannot be opened due to a high Δp across the valve.
7. Health Physics has been informed concerning the transfer.
8. The Refueling Cavity is clear of all personnel and foreign material.

8.23.2 Procedural Steps

1. Verify locked shut 1SF-201, Demin Water Supply Isolation to Fuel Pool Purification.
2. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.
3. Shut 1SF-191, Fuel Pool Purif Return to SFP Dnstream 1SF-205
4. Unlock and shut 1SF-186, Refueling Cavity Drain Isol to Cont Floor.
5. Verify shut 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 Cask PL.
6. Verify shut 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purif Sys Conn.
7. Verify shut 1SF-194, Reactor Cool Dr Tk Supply to Fuel Pool Purif Sys.

NOTE: The following Steps isolate the Refueling Water and Purification Pumps suction. The pumps must be placed under clearance to protect the pumps.

CAUTION

Continuous Surveillance of the Refueling Cavity and the Unit 1 Fuel Transfer Canal levels should be performed during water transfer.

8. Place the Fuel Pool and Refueling Water Purification Pumps 1&4A-NNS, and 1&4B-NNS under clearance.
9. Shut 1SF-121, Fuel Pool Purification Pump 1A suction Isol.
10. Shut 1SF-131, Fuel Pool Purification Pump 1B Isolation.
11. Verify open 1SF-149, Fuel Pool Purif Sys Supply Isol.

8.23 Gravity Fill of Refueling Cavity From Unit 1 Fuel Transfer Canal (continued)

12. Verify open 1SF-150, Fuel Pool Purification pump 1A and 1B Suction X Tie.

13. Open 1SF-146, Unit 1 Fuel Xfer Canal East Drain Isolation.

14. Open 1SF-147, Unit 1 Fuel Xfer Canal West Drain Isolation.

15. Unlock and open 1SF-118, Refuel Cavity Purification Suct CIV (IRC).

16. Unlock and open 1SF-119, Refuel Cavity Purification Suction CIV (ORC).

17. Verify open 1SF-212, Unit 1 Refuel Cav Purif Suct Isol.

18. Open 1SF-120, Refuel Cavity to Fuel Pool Purification Pumps 1A and 1B.

NOTE: Communications must be established between FHB 216 foot elevation at 1SF-148 and containment 286 foot elevation.

19. Open 1SF-148, Xfer Canal A Supply Isolation to Fuel Pool Purification Sys.

20. Complete Attachment 5.

21. When desired Refueling cavity level is achieved, or levels have equalized, shut 1SF-148.

22. Shut 1SF-120.

23. Shut 1SF-146.

24. Shut 1SF-147.

25. Lock shut 1SF-118.

26. Lock shut 1SF-119.

27. Open 1SF-121.

28. Open 1SF-131.

29. Open 1SF-202.

30. Open 1SF-191.

31. Complete Attachment 5.

32. Complete Attachment 15.

8.24 Filling Refueling Cavity from RWST

8.24.1 Initial Conditions

1. Sufficient quantity of water available in RWST such that when flood up is complete, the minimum requirements for Technical Specifications will be satisfied.
2. Fuel Pool Purification System is shutdown per Section 7.2.
3. Communications have been established between the Refueling Cavity, FHB and MCR.

8.24.2 Procedural Steps

1. Unlock and shut 1SF-186, Refueling Cavity Drain Isol to Cont Floor.
2. Unlock and open 1SF-118, Refueling Cavity Purification Suct CIV (IRC) outlet valve.

CAUTION

Opening 1CT-23 makes the RWST inoperable, due to purification lines not being seismically qualified. This is a one hour action in Modes 1 - 4.

---

3. Open 1CT-23, RWST to SFP Pump Suction Vlv.
4. Shut 1SF-150, Fuel Pool Purif Pumps 1A and 1B Suct Xtie Isol Vlv.
5. Shut 1SF-121, Fuel Pool Purif Pump 1A Suct Isol.
6. Open 1SF-193, RWST Supply Isol to Fuel Pool Purif Sys Isol Vlv.
7. Open 1SF-120, Unit 1 Refuel Cav to Fuel Pool Purif Pumps 1A and 1B Isol Vlv.
8. Shut 1SF-212, Unit 1 Refuel Cav Purif Suct Isol Vlv.
9. Unlock and open 1SF-119, Refueling Cavity Purification Suct CIV (ORC) Isol Vlv.

NOTE: When initially filling the Refueling Cavity, 1SF-212 must be throttled open such that the head of water generated during the fill process is limited to less than 1 foot. This is to prevent splashing of the water causing a problem with water clarity in the Refueling Cavity.

10. While maintaining the fill water head less than 1 foot, slowly throttle open 1SF-212, and begin filling Refueling Cavity.
11. Verify level increase in Refueling Cavity Unit 1.
12. Monitor water clarity in the Refueling Cavity, and adjust fill rate as necessary to maintain optimum clarity.
13. When level in the RWST is at 38 - 40%, secure filling the cavity through 1SF-212 by locking shut 1SF-118.
14. Lock shut 1SF-119.
15. Shut 1SF-212.
16. Shut 1SF-120.
17. Shut 1SF-193.

8.24 Filling Refueling Cavity from RWST (continued)

NOTE: Shutting 1CT-23 will restore the RWST to operable.

18. Shut 1CT-23.
19. Open 1SF-150.
20. Open 1SF-121.
21. Complete Attachment 24.

8.25 Transferring Water from RCDT to RWST Bypassing Purification Pumps

8.25.1 Initial Conditions

1. Attachments 1 and 2 are complete.
2. Radwaste Control Room and Operations have coordinated the transfer per OP-120.08.
3. The Fuel Pool Purification System has been shutdown per Section 7.2.
4. Attachment 26 has been performed to verify that when the transfer is complete, the RWST will be greater than or equal to 2400 ppm.

8.25.2 Procedural Steps

CAUTION

Chemistry should be notified when changing the purification flow path to ensure proper sample of the area being purified. This is done because Chemistry uses a sample point at the discharge of the pump, and may need to use another method of sampling if the flow path is changed.

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1. Place 1&4A-NNS and 1&4B-NNS Fuel Pools and Refueling Water Purification Pumps under Clearance with breakers tagged OFF.
2. Shut 1SF-202, SFP Supply Isol to Fuel Pool Purif Sys.
3. Check shut 1SF-203, FPP Sys Common Sup Header From Unit 2 and 3 and Cask Pl.
4. Check shut 1SF-201, Demin WT Supply Isol to Fuel Pool Purif.
5. Check shut 1SF-200, Fuel Xfer Canal Supply to Fuel Pool Purif Sys Comm.
6. Check shut 1SF-148, Transfer Canal A Supply Isol to Purif Sys.
7. Check shut 1SF-120, Unit 1 Refuel Cav to Fuel Pool Purif Pumps 1A & 1B.
8. Shut 1SF-131, Fuel Pool Purification Pump 1B Isolation.
9. Shut 1SF-121, Fuel Pool Purification Pump 1A Suction Isol.
10. Open 1SF-193, RWST Supply Isol to Fuel Pool Purif Sys.
11. Check shut 1SF-10, RWST to "A" Supply Isolation.

CAUTION

Opening 1CT-23 makes the RWST inoperable, due to purification lines not being seismically qualified. This is a one hour action in Modes 1 - 4.

---

12. Open 1CT-23, RWST to SFP Pump Suction.
13. Open 1SF-194, Reactor Cool Dr TK Supply to Fuel Pool Purif Sys.
14. Notify Radwaste Control Room the lineup is complete and to start the RCDT pump.
15. When transfer of the RCDT to the RWST is no longer required, have Radwaste Control Room secure the RCDT pump.

8.25 Transferring Water from RCDT to RWST Bypassing Purification Pumps (continued)

16. When transfer is complete:

NOTE: Shutting 1CT-23 will restore the RWST to operable.

a. Shut 1CT-23.

b. Shut 1SF-193.

c. Shut 1SF-194.

d. Open 1SF-121.

e. Open 1SF-131.

f. Open 1SF-202.

17. If desired, the clearance on the Purification pumps may be canceled.

18. Complete Attachment 25, to document valve manipulations.

19. Perform Section 8.9, RWST Purification, and sample to verify boron concentration.

8.26 Makeup to Fuel Pools using RMWST Water

8.26.1 Initial Conditions

1. Fuel Pool Purification is aligned to the Fuel Pools.

2. RMWST system is in service per OP-102 with at least one RMW Pump in service.

8.26.2 Procedural Steps

1. Open 1SF-194, Reactor Coolant Dr Tk Supply to Fuel Pool Purif Sys.

2. Open 3PM-83, RMW to BRS Evap 1&2B Cond Demin Isol Vlv.

3. Open 1PM-81, RMW to BRS Evap 1&2A Cond Demin Isol Vlv.

NOTE: 1PM-150, Reactor Make-up Water to Spent Fuel Pools, is a locked valve to prevent inadvertent dilution.

4. Unlock and open 1PM-150, Reactor Make-up Water to Spent Fuel Pools.

5. If operating RMW Pump pressure drops below 115 PSIG at PI-8910,(MCB) then 1PM-150 can be throttled as needed to obtain desired pressure.

6. When the desired fuel pool level is reached, shut and lock 1PM-150, Reactor Make-up Water to Spent Fuel Pools.

7. Shut 3PM-83, RMW to BRS Evap 1&2B Cond Demin Isol Vlv.

8. Shut 1PM-81, RMW to BRS Evap 1&2A Cond Demin Isol Vlv.

9. Shut 1SF-194, Reactor Coolant Dr Tk Supply to Fuel Pool Purif Sys.

8.27 Installation and Removal of Fuel Pool Gates

8.27.1 Initial Conditions

1. Maintenance has requested permission to perform one of the following per CM-M0118:

   - Remove Fuel Pool Gate
   - Install Fuel Pool Gate
   - Inflate or Deflate Fuel Pool Gate

8.27.2 Procedural Steps

1. Update the Operator Aid located in the Work Coordination Center with the requested Status.

2. Verify the following conditions are met as applicable.

   - Pools A and B have a clear path between them to allow cooling both pools. (either Gates 3 and 4 **OR** Gates 1, 2, and 4 are removed)
   - A path remains to connect all pools/canals which have purification suction or discharge aligned to them
   - A path remains to connect all pools/canals which have skimmer pump suction or discharge aligned to them

3. If the conditions in Step 8.27.2.2 remain met, inform Maintenance that they have permission to perform the CM-M0118 evolution.

4. When informed by Maintenance that the CM-M0118 evolution has been completed, complete Attachment 27.

5. File the Attachment 27 in the Control Room Status file, and forward any superceded Attachments to Document Services.

9.0 DIAGRAMS/ATTACHMENTS

Attachment 1 - Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist

Attachment 2 - Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

Attachment 3 - Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

Attachment 4 - Fuel Pool Cooling System Startup Valve Lineup Checklist

Attachment 5 - Fuel Pool Purification Current System Lineup

Attachment 6 - Fuel Pool Purification System Startup Valve Lineup Checklist

Attachment 7 - Fuel Pool Skimmer Valve Status Checklist

Attachment 8 - Fuel Pool Purification Shutdown Checklist

Attachment 9 - Fuel Pool Skimmer Shutdown Valve Lineup Checklist

Attachment 10 - Fuel Pool Cooling Fill and Vent Valve Lineup Checklist

Attachment 11 - Fuel Pool Purification Fill and Vent Valve Lineup Checklist

Attachment 12 - Fuel Pool Skimmer System Fill and Vent Valve Lineup Checklist

Attachment 13 - Makeup to Fuel Pools, Transfer Canals and Cask Loading Pool Lineup Checklist

Attachment 14 - Refueling Cavity Purification Valve Lineup Checklist

Attachment 15 - Transfer Canal, Refueling Cavity, Cask Loading Pool, Drain Valve Lineup Checklist

Attachment 16 - Fuel Transfer Canals and Cask Loading Pool Fill Lineup Checklist

Attachment 17 - Emergency Makeup to Fuel Pools from ESW

Attachment 18 - Unit 1 Fuel Pool and Fuel Transfer Canal Recirculation Lineup Checklist

Attachment 19 - Mode 6 Fuel Pool Cooling and Cleanup System Lineup to Prevent Dilution During Refueling

Attachment 20 - Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Lineup Checklist

Attachment 21 - Main Fuel Transfer Canal Purification Lineup Checklist

Attachment 22 - Recirculation of SFP B and Transfer Canal by Purification System Lineup Checklist

Attachment 23 - Securing from Purification Demin Rinse Purification Lineup Checklist

Attachment 24 - Securing from Filling Refueling Cavity from RWST Lineup Checklist

Attachment 25 - Securing from Transferring Water from RCDT to RWST Lineup Checklist

Attachment 26 - RWST Addition Manual Calculation Sheet

Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ________________________________ Date ____________
Unit SCO

After receiving the final review signature, this OP Attachment becomes a QA RECORD and should be submitted to Document Services.

Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	MCC 1&4A33-SA			
1&4A33-SA-4D	Spent Fuel Pool Cooling Pump 1&4A-SA	ON	_______	_______
	MCC 1&4B33-SB			
1&4B33-SB-2D	Spent Fuel Pool Cooling Pump 1&4B-SB	ON	_______	_______
	MCC 1-4A1021			
1-4A1021-1D	Refueling Water Purification Pump 1&4A-NNS	OFF	_______	N/A
1-4A1021-5E	Spent Fuel Pool Skimmer Pump 1&4A-NNS	OFF	_______	N/A
	MCC 1-4B1021			
1-4B1021-5E	Fuel Pool and Refueling Water Purification Pump 1&4B-NNS	OFF	_______	N/A
	PP-1-4A10221			
PP-1-4A10221-9	Local Cont PNL 3SF-SFPC9	ON	_______	N/A
PP-1-4A10221-8	Fuel Pool and Refueling Water Purification Pump 1&4A-NNS Motor Heater	ON	_______	N/A
	PP-1-4B10212			
PP-1-4B10212-2	Fuel Pool and Refueling Water Purification Pump 1&4B-NNS Motor Heater	ON	_______	N/A
	PP-1&4A33-SA			
PP-1&4A33-SA-37	Fuel Pool Cooling Pump 1&4A-SA Motor Heater	ON	_______	N/A

Fuel Pool Cooling and Cleanup System Electrical Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	PP-1&4B33-SB		
PP-1&4B33-SB-37	Fuel Pool Cooling Pump 1&4B-SB Motor Heater	ON	______
	PP-1-4A111		
PP-1-4A111-19	Fuel Pool Skimmer Filter 1 & 4 Local Control Panel	ON	______
PP-1-4A111-21	Fuel Pool Demineralizer Filter 1 & 4 Local Control Panel	ON	______
PP-1-4A111-22	Fuel Pool Purification Filter 1 & 4 Local Control Panel	ON	______
PP-1-4A111-27	Local Cont PNL 3SF-SFPC7	ON	______

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

Approved by ____________________ Date ________
Unit SCO

After receiving the final review signature, this OP Attachment becomes a QA RECORD and should be submitted to Document Services.

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	216 FHB			
1SF-146	Unit 1 Fuel Xfer Canal East Drain Isol	SHUT	_______	N/A
1SF-147	Unit 1 Fuel Xfer Canal West Drain Isol	SHUT	_______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	SHUT	_______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass From Pump 1A	SHUT	_______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	SHUT	_______	N/A
1SF-138	Fuel Pool Purif Pumps 1A & 1B Disc X-Tie	SHUT	_______	N/A
1SF-156	Fuel Pool Purif Pump 1A Disc Sample & Drain	SHUT & CAPPED	_______	N/A
1SF-177	Fuel Pool Demineralizer A Disc Header Drain Isol	SHUT	_______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	SHUT	_______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	_______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	SHUT	_______	N/A
1SF-166	FPRW Purif Pump B Discharge Sample Root	SHUT & CAPPED	_______	N/A
1SF-133	Fuel Pool Purif Pump 1B Disch Isol	THROTTLED	_______	N/A
1SF-164	Fuel Pool Purif Pump 1B Disc PI-5190B Isol	OPEN	_______	N/A
1SF-163	Fuel Pool Purif Pump 1B Disc PS-5190B Isol	OPEN	_______	N/A
1SF-165	Fuel Pool Purif Pump 1B Casing Drain	SHUT	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	216 FHB (continued)			
1SF-162	Fuel Pool Pump Purif 1B Suct Isol After ST SF-S5	SHUT & CAPPED	_______	N/A
1SF-161	Fuel Pool Purif Pump 1B Suct Isol Before ST SF-S5	SHUT & CAPPED	_______	N/A
1SF-131	Fuel Pool Purif Pump 1B Isol	OPEN	_______	N/A
1SF-160	Fuel Pool Purif Pump 1B Suct Line Drain	SHUT & CAPPED	_______	N/A
1SF-203	FPP Sys Common Sup Header From Unit 2 and 3 and Cask PL	SHUT	_______	N/A
1SF-202	SFP Supply Isol to Fuel Pool Purif Sys	OPEN	_______	N/A
1SF-201	Demin WT Supply Isol to Fuel Pool Purif	LOCKED SHUT	_______	N/A
1SF-200	Fuel Xfer Canal Supply to Fuel Pool Purif Sys Comm	SHUT	_______	N/A
1SF-194	Reactor Cool Dr Tk Supply to Fuel Pool Purif Sys	SHUT	_______	N/A
1SF-195	Fuel Pool Purif Supply Drain Isol	SHUT & CAPPED	_______	N/A
1SF-148	Transfer Canal A Supply Isol to Purif Sys	SHUT	_______	N/A
1SF-149	Fuel Pool Purif Sys Supply Isol	OPEN	_______	N/A
1SF-150	Fuel Pool Purif Pumps 1A&1B Suct X-TIE	OPEN	_______	N/A
1SF-120	Unit 1 Refuel Cav to Fuel Pool Purif Pumps 1A&1B	SHUT	_______	N/A
1SF-193	RWST Supply Isol to Fuel Pool Purif Sys	SHUT	_______	N/A
1SF-121	Fuel Pool Purif Pump 1A Suct Isol	OPEN	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	216 FHB (continued)			
1SF-151	Fuel Pool Purif Pump 1A Suct Isol Before ST SF-S6	SHUT & CAPPED	_______	N/A
1SF-152	Fuel Pool Purif Pump 1A Suct Isol After ST SF-S6	SHUT & CAPPED	_______	N/A
1SF-155	Fuel Pool Purif Pump 1A Casing Drain	SHUT	_______	N/A
1SF-154	Fuel Pool Purif Pump 1A Disc PI-5190A	OPEN	_______	N/A
1SF-153	Fuel Pool Purif Pump 1A Disc PS-5190A	OPEN	_______	N/A
1SF-123	Fuel Pool Purif Pump 1A Disch Isol	THROTTLED	_______	N/A
1SF-206	Fuel Pool Purif Return Isol to Unit 2 & 3	SHUT	_______	N/A
1SF-192	Fuel Pool Purif Sys Return to Xfer Canal A	SHUT	_______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	OPEN	_______	N/A
1SF-205	Fuel Pool Purif Return Isol to Fuel Pools	OPEN	_______	N/A
1SF-180	Fuel Pool Sys FT-5154B Hi Side Isol	OPEN	_______	N/A
1SF-181	Fuel Pool Sys FT-5154B Lo Side Isol	OPEN	_______	N/A
1SF-179	Fuel Pool Sys Supply Isol Downstream of FE-5154	SHUT & CAPPED	_______	N/A
1SF-141	Fuel Pool Purif Sys Disc Isol	OPEN	_______	N/A
1SF-190	Fuel Pool Purif Sys Return Sample & Equip Isol Dr	SHUT & CAPPED	_______	N/A
1SF-189	Fuel Pool Purif Return to SFP Downstream 1SF-141	SHUT	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	216 FHB (continued)			
1SF-188	Fuel Pool Purif Return Isolation	SHUT	______	N/A
1SF-182	Fuel Pool Sys FT-5154A Hi Side Isol	OPEN	______	N/A
1SF-183	Fuel Pool Sys FT-5154A Lo Side Isol	OPEN	______	N/A
1SF-184	Fuel Pool Sys to Refueling Cav Drain Isol	SHUT	______	N/A
1SF-187	Fuel Pool Purif Return to RWST	SHUT	______	N/A
1SF-143	Fuel Pool Purif Sys A Supply to Refuel Cav	SHUT	______	N/A
2SF-199	Cask Loading Pools to Fuel Pool Purif Suct	SHUT	______	N/A
2SF-203	Fuel Pool Purif Supply to Cask Loading Pool	SHUT	______	N/A
2SF-146	Unit 2 Fuel Xfer Canal East Drain to Purification System	SHUT	______	N/A
2SF-147	Unit 2 Fuel Xfer Canal West Drain to Purification system	SHUT	______	N/A
2SF-202	Fuel Pool Purif Suct Isol From Unit 2 & 3 Fuel Pool	LOCKED SHUT	______	N/A
2SF-201	Demin WT Sup to Fuel Pool Purif Sys From Unit 2&3	LOCKED SHUT	______	N/A
2SF-200	Cask Loading Pool to Fuel Pool Purif Suct	SHUT	______	N/A
2SF-195	Fuel Pool Purif Supply Drain Isol	SHUT & CAPPED	______	N/A
2SF-148	Unit 2&3 Supply Isol to Fuel Pool Purif Sys A	SHUT	______	N/A
2SF-149	Unit 2&3 Supply Isol to FP Purification Sys	LOCKED SHUT	______	N/A
2SF-192	Fuel Pool Purif Sys Rtn to Unit 2 Xfer Canal	LOCKED SHUT	______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	216 FHB (continued)			
2SF-191	Fuel Pool Purif Sys to B Fuel Pool Return Isol	LOCKED SHUT	______	N/A
2SF-205	Fuel Pool Purif to Cask Loading Pool	LOCKED SHUT	______	N/A
2SF-181	FT-5154B Outlet	LOCKED SHUT	______	N/A
2SF-179	Fuel Pool Purif Return Header Sample Isol	SHUT & CAPPED	______	N/A
2SF-141	Fuel Pool Purif Supply to Cask Loading Pool	LOCKED SHUT	______	N/A
2SF-190	Fuel Pool Purif Return Header Smpl and Drain Isol	SHUT & CAPPED	______	N/A
2SF-189	Fuel Pool Purif Return to B Fuel Pool	LOCKED SHUT	______	N/A
2SF-183	FT-5154A Outlet	LOCKED SHUT	______	N/A
2SF-184	Fuel Pool Purif Supply to Cask Loading Pool Drain Isol	SHUT & CAPPED	______	N/A
2SF-188	Fuel Pool Purif Supply Isol to Cask Load Pool	SHUT	______	N/A
	236 FHB			
1SF-196	Fuel Xfer Canal NW Supply Isol to Fuel Pool Purif	SHUT	______	N/A
1SF-49	1A FPC SYS Drain DN Stream of FT-5100A	SHUT & CAPPED	______	______
1SF-71	1B FPC Sys Drain DN Stream of FT-5100B	SHUT & CAPPED	______	______
1SF-47	A Train Return to Unit 1 NFP FT-5100A HP Isolation	OPEN	______	______
1SF-48	A Train Return to Unit 1 NFP FT-5100A LP Isol	OPEN	______	______

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-69	B Train Return to Unit 1 NFP FT-5100B HP Isol	OPEN		
1SF-70	B Train Return to Unit 1 NFP FT-5100B LP Isolation	OPEN		
1SF-50	A Train Return to Unit 1 SFP FT-5110A HP Isolation	OPEN		
1SF-51	A Train Return to Unit 1 SFP FT-5110A LP Isolation	OPEN		
1SF-72	B Train Return to Unit 1 SFP FT-5110B HP Isolation	OPEN		
1SF-26	FP Purif Sys Return Isol to A FPC to NFP	SHUT		
1SF-73	B Train Return to Unit 1 SFP FT-5110B LP Isolation	OPEN		
1SF-27	FP Purif Sys Return Isol to B FPC to NFP	SHUT		
1SF-28	FP Purif Sys Ret Isol to B FPC to Spent Fuel Pools	SHUT		
1SF-29	FP Purif Sys Rtn Isol to A FPC to Spent Fuel Pools	SHUT		
1SF-7	Fuel Pool Cooling Supply Isol to New Fuel Pool	SHUT		
1SF-17	Fuel Pool Cooling Supply Isol to New Fuel Pool	SHUT		
1SF-8	Fuel Pool Cooling Supply Isol to Spent Fuel Pool	OPEN		
1SF-18	Fuel Pool Cooling Supply Isol to Spent Fuel Pool	OPEN		
1SF-214	NFP Supply to A Train Vent	SHUT & CAPPED		
1SF-74	NFP-1 to A Train Low Point Return Drain	SHUT & CAPPED		

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-75	NFP Supply to B Train Low Point Drain	SHUT & CAPPED	______	______
1SF-224	SFP to A Train Vent	SHUT & CAPPED	______	______
1SF-116	Unit 1 Fuel Xfer Canal Skimmer Suction Line Drain	SHUT & CAPPED	______	N/A
1SF-115	Unit 1 NFP Skimmer Suction Line Drain Isolation	SHUT & CAPPED	______	N/A
1SF-114	Unit 1 NFP Skimmer Return Drain Isol	SHUT & CAPPED	______	N/A
1SF-88	Skimmer Return Isol to Main Fuel Xfer Canal	SHUT	______	N/A
1SF-87	Skimmer Return Isol to Unit 1 SFP	SHUT	______	N/A
1SF-82	Unit 1 SFP Common Skimmer Suct Isolation	OPEN	______	N/A
1SF-93	Unit 1 NFP Common Skimmer Suct Isolation	SHUT	______	N/A
1SF-98	Unit 1 NFP Skimmer Return Isol	SHUT	______	N/A
1SF-96	Fuel Xfer Canal to Skimmer Pumps Isol	OPEN	______	N/A
1SF-97	Unit 1 Fuel Xfer Canal Skimmer Return Isol	SHUT	______	N/A
1SF-99	Skimmer Pumps A&B X-tie Isol	LOCKED SHUT	______	N/A
1SF-101	Skimmer Strainer A Hi Side Isol to PDS-5109	OPEN	______	N/A
1SF-102	Skimmer Strainer A Lo Side Isol to PDS-5109	OPEN	______	N/A
1DW-527	DW Iso To Fuel Pools Skimmer Pump Strainer 1&4X-NNS	LOCKED SHUT	______	______
1SF-103	Skimmer Strainer A Inlet Drain Isol	SHUT	______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-104	Skimmer Strainer A Inlet Drain Isol	SHUT	______	N/A
1SF-105	Skimmer Strainer A Drain Isol	SHUT	______	N/A
1SF-106	Skimmer Strainer A Drain Isol	SHUT	______	N/A
1SF-107	Skimmer Strainer A Outlet Drain Isol	SHUT	______	N/A
1SF-108	Skimmer Strainer A Outlet Drain Isol	SHUT	______	N/A
1SF-220	Fuel Pools Skimmer Pmp Strainer 1&4X-NNS Vent Vlv	SHUT & CAPPED	______	N/A
1SF-83	Fuel Pool Skimmer Pump A Suction Isol	OPEN	______	N/A
1SF-109	Fuel Pool Skimmer Pump A Casing Drain	SHUT	______	N/A
1SF-110	Fuel Pool Skimmer Pump A Isol to PI-5111	OPEN	______	N/A
1SF-111	Fuel Pool Filter A Hi Side Isol to PDT-5112 Inlet	OPEN	______	N/A
1SF-112	Fuel Pool Filter A Lo Side Isol to PDT-5112 Outlet	OPEN	______	N/A
3IA-437-I10	Instrument Air Isolation Valve to 1SF-85	OPEN	______	N/A
3IA-436-I3	Inst Air Isol Valve to 1SF-113	OPEN	______	N/A
3IA-436-I4	Inst Air Isol Valve to 1SF-86	OPEN	______	N/A
1SF-100	Skimmer Pumps A&B Disc X-tie	LOCKED SHUT	______	N/A
3IA-437-I1	Instrument Air Isolation Valve to 1SF-135	OPEN	______	N/A
3IA-437-I4	Instrument Air Isolation Valve to 1SF-134	OPEN	______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
3IA-437-I8	Instrument Air Isolation Valve to 1SF-125	OPEN	______	N/A
3IA-437-I7	Instrument Air Isolation Valve to 1SF-124	OPEN	______	N/A
3IA-436-I2	Inst Air Isol Valve to 1SF-158	OPEN	______	N/A
3IA-436-I1	Inst Air Isol Valve to 1SF-168	OPEN	______	N/A
1SF-167	Fuel Pool Demin Filter 1B Hi Side to PDT-5152B	OPEN	______	N/A
1SF-169	Fuel Pool Demin Filter 1B Lo Side to PDT-5152B	OPEN	______	N/A
1SF-157	Fuel Pool Purif Filter 1A Hi Side to PDT-5152A	OPEN	______	N/A
1SF-159	Fuel Pool Purif Filter 1A Lo Side to PDT-5152A	OPEN	______	N/A
1SF-62	1B-SB FPC System Isol to PT-5140	OPEN	______	______
1SF-61	1&4B-SB FPC Pump Slt Pump Disch Isol	SHUT	______	______
1SF-14	1&4B Fuel Pool Cooling Pump Disch Isol	OPEN	______	______
1SF-60	1&4 FPC Pump Disc Isol to PI-5130B	OPEN	______	______
1SF-59	1&4B-SB Fuel Pool Cooling Pump Casing Vent	SHUT & CAPPED	______	______
1SF-57	1&4B-SB FPC Pmp Disch Drain	SHUT	______	______
1SF-56	1&4B-SB FPC Pmp Suction Drain	SHUT	______	______
1SF-55	1&4B-SB FPC Pump Suction Test Root	SHUT & CAPPED	______	______
1SF-12	1&4B-SB Fuel Pool Cooling Pump Suction Isol	OPEN	______	______
1SF-20	1B-SB Fuel Pool Cooling Supply to Purif Sys	SHUT	______	______

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-54	1&4B-SB FPC Pmp Alt Pmp Suction Isol	SHUT	_______	_______
1SF-58	1B-SB Fuel Pool Strainer Drain Isol	SHUT	_______	_______
1SF-53	PDS-5130B Low Side to 1B-SB FP Strainer	OPEN	_______	_______
1SF-52	PDS-5130B High Side to 1B-SB FP Strainer	OPEN	_______	_______
1SF-40	A Train Hdr Press PT-5140A Isol	OPEN	_______	_______
1SF-39	Emerg FPC Pump Disch Isol to A Train	SHUT	_______	_______
1SF-4	FPC Pump 1&4A-SA Disch Isol	OPEN	_______	_______
1SF-38	FPC Pump 1&4A-SA Disc Press PI-5130A Isol	OPEN	_______	_______
1SF-37	FPC Pump 1&4A-SA Casing Vent	SHUT & CAPPED	_______	_______
1SF-35	FPC Pump 1&4A-SA Discharge Drain	SHUT	_______	_______
1SF-34	FPC Pump 1&4A-SA Suction Drain	SHUT	_______	_______
1SF-33	FPC Pump 1&4A-SA Suction Test Conn	SHUT & CAPPED	_______	_______
1SF-2	FPC Pump 1&4A-SA Suction Isol	OPEN	_______	_______
1SF-32	Emerg FPC Pump Suction Isol to A Train	SHUT	_______	_______
1SF-21	A Train Supply to Purif Sys	SHUT	_______	_______
1SF-22	FPC System Supply Isol to Purification System	SHUT	_______	_______
1SF-221	Fuel Pool Cooling Supply to Purif Sys Vent Isol	SHUT & CAPPED	_______	_______
1SF-31	PDS-5130A LP Isol for A Train Str	OPEN	_______	_______
1SF-30	PDS-5130A HP Isol for A Train Str	OPEN	_______	_______

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-36	A Train Str Drain	SHUT	_______	_______
1SF-9	NFP to A Train Supply Isolation	SHUT	_______	_______
1SF-222	New Fuel Pool to B Train Vent Isol	SHUT & CAPPED	_______	_______
1SF-19	NFP to B Train Supply Isolation	SHUT	_______	_______
1SF-10	RWST to A Supply Isolation	SHUT	_______	_______
1SF-215	RWST Supply Line Vent	SHUT & CAPPED	_______	_______
1SF-1	SFP Supply to A Train Isolation	OPEN	_______	_______
1SF-223	NFP and SFP to B Train Vent Isolation	SHUT & CAPPED	_______	_______
1SF-11	SFP Supply to B Train Isolation	OPEN	_______	_______
1SF-25	1B-SB FPC Supply to Transfer Canal	SHUT	_______	_______
1SF-24	A Train Supply to Xfer Canal Isol	SHUT	_______	_______
1SF-23	FPC Sys Supply Fill Isol to Transfer Canal U-1&4	SHUT	_______	_______
1SF-5	Fuel Pool Hx 1&4A-SA Inlet Isol	OPEN	_______	_______
1SF-41	FPC Hx 1&4A Inlet Test Root	SHUT & CAPPED	_______	_______
1SF-42	1&4A-SA Hx Outlet Px Conn	SHUT & CAPPED	_______	_______
1SF-6	1&4A-SA Hx Outlet Isol	THROTTLED	_______	_______
1SF-43	1&4A-SA Heat Exchanger Tube Side Vent Isol	SHUT & CAPPED	_______	_______
1SF-44	1&4A-SA Heat Exchanger Tube Side Drain Isol	SHUT	_______	_______
1SF-15	1&4B-SB Heat Exchanger Inlet	OPEN	_______	_______

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-63	Fuel Pool 1&4B-SB Hx Inlet Px Conn	SHUT & CAPPED	_______	_______
1SF-16	1&4B-SB Hx Outlet	THROTTLED	_______	_______
1SF-64	Fuel Pool 1&4B-SB Hx Outlet Px Conn	SHUT & CAPPED	_______	_______
1SF-67	Fuel Pool 1&4B-SB Heat Exchanger Tube Side Vent	SHUT & CAPPED	_______	_______
1SF-65	Fuel Pool 1&4B-SB Heat Exchanger Tube Side Drain	SHUT	_______	_______
1SF-46	1&4A-SA FPC Sys Drain Downstream of Hx	SHUT	_______	_______
1SF-68	Fuel Pool 1&4B-SB Hx Outlet Line	SHUT	_______	_______
1SF-204	FPP Sys Com Supply HDER From Unit 2 & 3 Cask Pool Drain	SHUT	_______	N/A
1SF-207	Fuel Pool Purif Return Header to Unit 2 & 3 Drain	SHUT	_______	N/A
1SF-199	Fuel Xfer Canal Sup Common HDER to FP Purif Sys Drain	SHUT & CAPPED	_______	N/A
2SF-23	FPC Sys Supply Fill Isol to Transfer Canal U-2&3	LOCKED SHUT	_______	N/A
2SF-101	Hi Side Isol to PDS-5109	SHUT	_______	N/A
2SF-102	Lo Side Isol to PDS-5109	SHUT	_______	N/A
2SF-104	Fuel Pools Skimmer Pump Strainer Drain	SHUT	_______	N/A
2SF-103	Fuel Pools Skimmer Pump Strainer Drain	SHUT	_______	N/A
2SF-106	Fuel Pools Skimmer Pump Strainer Drain	SHUT	_______	N/A
2SF-105	Fuel Pools Skimmer Pump Strainer Drain	SHUT	_______	N/A
2SF-107	Fuel Pools Skimmer Pump Strainer Drain	SHUT	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
2SF-108	Fuel Pools Skimmer Pump Strainer Drain	SHUT	_______	N/A
2SF-83	Fuel Pools Skimmer Pump Suction Isol	LOCKED SHUT	_______	N/A
2SF-86	Fuel Pools Skimmer Filter Outlet	* LOCKED SHUT	_______	N/A
2SF-112	PDT-5112 Outlet	LOCKED SHUT	_______	N/A
2SF-178	Skimmer Pumps Discharge Header Drain	LOCKED SHUT	_______	N/A
2SF-117	Common Skimmer Suction Line Drain Isol	LOCKED SHUT	_______	N/A
2SF-116	Fuel Transfer Canal Outlet Drain	SHUT & CAPPED	_______	N/A
2SF-93	New Fuel Pool to Skimmer Pumps Isol	LOCKED SHUT	_______	N/A
2SF-97	Fuel Transfer Canal Inlet Isolation	LOCKED SHUT	_______	N/A
2SF-98	New Fuel Pool Inlet Isol	LOCKED SHUT	_______	N/A
2SF-82	Spent Fuel Pool to Skimmer Pumps	LOCKED SHUT	_______	N/A
2SF-87	Skimmer Return Inlet to SFP #2	LOCKED SHUT	_______	N/A
2SF-88	Skimmer Return Isol to Main Fuel Xfer Canal	LOCKED SHUT	_______	N/A
2SF-96	Fuel Transfer Canal to Skimmer Pumps	OPEN	_______	N/A
2SF-99	Skimmer Return to Cask Loading Pool (Units 1&2)	SHUT	_______	N/A

* Inst Air Disconnected satisfies Locked Position

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
1SF-197	Fuel Xfer Canal N Supply Isol to Fuel Pool Purif	SHUT	______	N/A
1SF-198	Fuel Xfer Canal NE Supply Isol to Fuel Pool Purif	SHUT	______	N/A
1SF-216	RWST Supply Line Drain	SHUT & CAPPED	______	______
1SF-76	SFPCCS Emerg Makeup Conn Vent Vlv	SHUT & CAPPED	______	______
1SF-144	Refueling Cavity Purification Discharge CIV(ORC)	LOCKED SHUT	______	______
1DW-365	Demin Water Isol to Unit 2&3 Fuel Pools and FPPS	LOCKED SHUT	______	N/A
1FB-59	Fuel Pool Skimmer Filter 1&4 Drain Vlv	SHUT	______	N/A
1FB-60	Fuel Pool Skimmer Filter 1&4 Backup Drain Vlv	SHUT	______	N/A
1FB-61	Fuel Pool Purif Filter 1&4 Drain Vlv	SHUT	______	N/A
1FB-62	Fuel Pool Purif Filter 1&4 Backup Drain Vlv	SHUT	______	N/A
1FB-63	Fuel Pool Demin Filter 1&4 Drain Vlv	SHUT	______	N/A
1FB-64	Fuel Pool Demin Filter 1&4 Back up Drain Vlv	SHUT	______	N/A
3IA-437-I11	Instrument Air Isolation Valve to 1DW-21	OPEN	______	N/A
3IA-437-I5	Instrument Air Isolation Valve to 1FB-56	OPEN	______	N/A
3IA-437-I3	Instrument Air Isolation Valve to 1DW-25	OPEN	______	N/A
3IA-437-I6	Instrument Air Isolation Valve to 1DW-23	OPEN	______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	236 FHB (continued)			
3IA-437-I2	Instrument Air Isolation Valve to 1FB-57	OPEN	______	N/A
3IA-437-I9	Instrument Air Isolation Valve to 1FB-55	OPEN	______	N/A
3IA-436-I5	Instrument Air Isolation Valve to 1NI-146	OPEN	______	N/A
3IA-436-I6	Inst Air Isol Valve to 1NI-148	OPEN	______	N/A
3IA-436-I7	Inst Air Isol Valve to 1NI-150	OPEN	______	N/A
1SF-211	Unit 1 Refuel Cav Purif Return Drain Isol	SHUT & CAPPED	______	N/A
1SF-210	Unit 1 Refuel Cavity Purif Return	SHUT	______	N/A
1SF-212	Unit 1 Refuel Cav Purif Suct Isol	SHUT	______	N/A
1SF-213	Unit 1 Refuel Cav Purif Suct Drain Isol	SHUT & CAPPED	______	N/A
1SF-119	Refuel Cavity Purification Suction CIV (ORC)	LOCKED SHUT	______	______
	261 FHB			
1FB-58	FHB-1 Backwash Transfer Tk Inlet Vlv	OPEN	______	N/A
1SF-128	Fuel Pool Purif Demin A Inlet Isol	OPEN	______	N/A
1SF-129	Fuel Pool Purif Demin A Outlet Isol	OPEN	______	N/A
1SF-208	Fuel Pool Demin A Spent Resin Supply	SHUT	______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	261 FHB (continued)			
1SF-176	Fuel Pool Demineralizer Sample Isol	SHUT & CAPPED	_______	N/A
1SF-209	Fuel Pool Demin A to Spent Resin Stor Tank	SHUT	_______	N/A
1SF-170	Fuel Pool Demin A Hi Side Isol to PDI-5150	OPEN	_______	N/A
1SF-175	Fuel Pool Demin A Lo Side Isol to PDI-5150	OPEN	_______	N/A
1SF-172	Fuel Pool Demineralizer A Vent Isol	SHUT	_______	N/A
1SF-171	Fuel Pool Demineralizer A Vent Isol	SHUT & CAPPED	_______	N/A
1SF-174	Fuel Pool Demin A Resin Fill Vlv	SHUT	_______	N/A
1SF-173	Fuel Pool Demineralizer A Resin Fill	SHUT & FLANGED	_______	N/A
1DW-40	Demin Water Maintenance Decon Supply Connection Isol Vlv	SHUT	_______	N/A
	286 FHB			
1SF-90	Unit 1 NFP Northwest Skimmer Suction Isol	SHUT	_______	N/A
1SF-91	Unit 1 NFP North Skimmer Suct Isol	SHUT	_______	N/A
1SF-92	Unit 1 NFP NE Skimmer Suct Isol	SHUT	_______	N/A
1DW-35	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-37	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-39	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1SF-94	Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol	SHUT	_______	N/A
1SF-95	Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol	SHUT	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	286 FHB (continued)			
1DW-36	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-38	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1SF-77	Unit 1 SFP South Skimmer Suct Isol	SHUT	_______	N/A
1SF-78	Unit 1 SFP Northeast Skimmer Suct Isol	SHUT	_______	N/A
1SF-79	Unit 1 SFP SW Skimmer Suct Isol	SHUT	_______	N/A
1SF-80	Unit 1 SFP Northwest Skimmer Suct Isol	SHUT	_______	N/A
1SF-81	Unit 1 SFP Northwest Skimmer Suct Isol	SHUT	_______	N/A
1DW-29	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-30	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-31	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-32	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
1DW-33	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______	N/A
2DW-29	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-30	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-31	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-32	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-33	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	286 FHB (continued)			
2DW-34	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-35	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-36	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-37	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-38	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2DW-39	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	SHUT	_______	N/A
2SF-94	Suction to Fuel Trans Canal Unit 2	SHUT	_______	N/A
2SF-95	Suction to Fuel Trans Canal Unit 2	SHUT	_______	N/A
2SF-100	Cask Loading Pool Skimmer Outlet Isol	SHUT	_______	N/A
2SF-89	Main Xfer Canal Northeast Skimmer Suct Isol	LOCKED SHUT	_______	N/A
1SF-89	Main Xfer Canal South Skimmer Suct Isol	SHUT	_______	N/A
1DW-34	FHB Upender Supply Isol Vlv	SHUT	_______	N/A
	Containment			
1SF-145	Refueling Cavity Purification Return CIV (IRC) (C-245-AZ85-RAD65)	LOCKED SHUT	_______	_______
1SF-186	Refueling Cavity Drain Isol to Cont Floor (C-238-AZ5-RAD47)	LOCKED OPEN	_______	N/A
1SF-185	Refueling Cavity Drain Isol to Floor Hub (C-236-AZ5-RAD47)	LOCKED SHUT	_______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Containment (continued)			
1SF-219	FPCS Purif Pmp Suction From Refueling Cavity Vent Valve (C-245-AZ2-RAD60)	SHUT & CAPPED	______	N/A
1SF-118	Refuel Cavity Purification Suct CIV (C-245-AZ 351-RAD71)	LOCKED SHUT	______	______
	Backwash Control Panel			
1SF-113	Fuel Pool Filter A Vent Valve	SHUT	______	N/A
1SF-168	Fuel Pools Demin Filter 1B Vent Isol	SHUT	______	N/A
1SF-158	Fuel Pool Purif Filter 1A Vent Isolation	SHUT	______	N/A
1NI-150	N_2 Distribution Fuel Pool Skimmer Filter 1&4X Backflush Valve	SHUT	______	N/A
1DW-21	Demin Water to Fuel Pool Skimmer Filter 1&4X	SHUT	______	N/A
1FB-55	Fuel Pool Skimmer Filter Backwash Outlet Vlv	SHUT	______	N/A
1NI-148	Fuel Pool Purif Filter 1&4X N_2 Inlet	SHUT	______	N/A
1DW-23	Demin Wtr Isol to Fuel Pool & Refuel Wtr Pmp Filter 1&4X	SHUT	______	N/A
1FB-56	Fuel Pool Purif Filter Backwash Outlet Vlv	SHUT	______	N/A
1NI-146	N_2 Distribution Fuel Pool Demin Filter 1&4X Backflush Vlv	SHUT	______	N/A
1DW-25	Demin Water Isol to Fuel Pool Demin Filter 1&4X	SHUT	______	N/A
1FB-57	Fuel Pool Demin Filter Backwash Outlet Vlv	SHUT	______	N/A
BCP	ACCUMULATOR & FILTER DIFFERENTIAL PRESSURE OVERRIDE	NORMAL	______	N/A

Fuel Pool Cooling and Cleanup System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	BOP Filters Panel			
1SF-85/1SF-86	FP SKIMMER FLTR 1&4 IN/OUT VLVS	OPEN	______	N/A
1SF-134/1SF-135	FP DEMIN FLTR 1&4 IN/OUT VLVS	OPEN	______	N/A
CS-4241 BOP FILTERS	FHB N_2 ACCUM 1&4 Charging VLV 1NI-138	AUTO	______	N/A
1SF-124/1SF-125	FP WTR PURIF FLTR 1&4 IN/OUT VLVS	OPEN	______	N/A
	Unit 2 Fuel Pools C and D			
2SF-49	FPC Pump Return To "D" Pool Drain (F-236-N55-W4-N25)	SHUT & CAPPED	______	N/A
2SF-212	SFP Pump Return To "D" Pool Drain (F-247-N55-E6-N29)	SHUT & CAPPED	______	N/A
2SF-74	FPC Pump Suction From "D" Pool Drain	SHUT & CAPPED	______	N/A
2SF-75	FPC Pump Suction From "D" Pool Drain	SHUT & CAPPED	______	N/A
2SF-216	SFP Pump Suction From "D" Pool Drain (F-242-M45-W2-N2)	SHUT & CAPPED	______	N/A
2SF-214	SFP Pump Return To "C" Pool Drain (F-251-N55-E4-N6)	SHUT & CAPPED	______	N/A
2SF-213	SFP Pump Return To "C" Pool Drain (F-251-N55-E6-N8)	SHUT & CAPPED	______	N/A
2SF-19	FPC Pump Suction From "D" Pool Isol	SHUT	______	N/A
2SF-215	SFP Pump Suction From "C" Pool Drain (F-264-M50-E7-S4)	SHUT & CAPPED	______	N/A
2SF-11	FPC Pump Suction From "C" Pool Isol	SHUT	______	N/A

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

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Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

Approved by ______________________________ Date ________
Unit SCO

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Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	216 FHB South		
1LD-1	South New Fuel Pit Zone-4 LD Vlv	SHUT	______
1LD-2	South New Fuel Pit Zone-3 LD Vlv	SHUT	______
1LD-3	South New Fuel Pit Zone-2 LD Vlv	SHUT	______
1LD-4	South New Fuel Pit Sump Zone-1 LD Vlv	SHUT	______
1LD-5	South New Fuel Pit Zone-8 LD Vlv	SHUT	______
1LD-6	South New Fuel Pit Zone-7 LD Vlv	SHUT	______
1LD-7	South New Fuel Pit Zone-6 LD Vlv	SHUT	______
1LD-8	South New Fuel Pit Zone-5 LD Vlv	SHUT	______
1LD-9	South New Fuel Pit Gate Zone-1 LD Vlv	SHUT	______
1LD-10	South Fuel Transfer Canal Zone-12 LD Vlv	SHUT	______
1LD-11	South Fuel Transfer Canal Zone-11 LD Vlv	SHUT	______
1LD-12	South Fuel Transfer Canal Zone-10 LD Vlv	SHUT	______
1LD-13	South Fuel Transfer Canal Zone-9 LD Vlv	SHUT	______
1LD-14	South Fuel Transfer Canal Zone-8 LD Vlv	SHUT	______
1LD-15	South Fuel Transfer Canal Zone-7 LD Vlv	SHUT	______
1LD-16	South Fuel Transfer Canal Zone-6 LD Vlv	SHUT	______
1LD-17	South Fuel Transfer Canal Zone-5 LD Vlv	SHUT	______
1LD-18	South Fuel Transfer Canal Zone-4 LD Vlv	SHUT	______
1LD-19	South Fuel Transfer Canal Zone-3 LD Vlv	SHUT	______
1LD-20	South Fuel Transfer Canal Zone-2 LD Vlv	SHUT	______
1LD-21	South Fuel Transfer Canal Zone-1 LD Vlv	SHUT	______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	216 FHB North		
1LD-90	North Spent Fuel Pool Zone-1 LD Vlv	SHUT	______
1LD-91	North Spent Fuel Pool Zone-2 LD Vlv	SHUT	______
1LD-92	North Spent Fuel Pool Zone-3 LD Vlv	SHUT	______
1LD-93	North Spent Fuel Pool Sump Zone-4 LD Vlv	SHUT	______
1LD-94	North Spent Fuel Pool Zone-5 LD Vlv	SHUT	______
1LD-95	North Spent Fuel Pool Zone-6 LD Vlv	SHUT	______
1LD-96	North Spent Fuel Pool Zone-7 LD Vlv	SHUT	______
1LD-97	North Spent Fuel Pool Zone-8 LD Vlv	SHUT	______
1LD-98	North Spent Fuel Pool Zone-9 LD Vlv	SHUT	______
1LD-99	North Spent Fuel Pool Zone-10 LD Vlv	SHUT	______
1LD-100	North Spent Fuel Pool Zone-11 LD Vlv	SHUT	______
1LD-101	North Spent Fuel Pool Zone-12 LD Vlv	SHUT	______
1LD-102	North Fuel Transfer Canal Zone-12 LD Vlv	SHUT	______
1LD-103	North Fuel Transfer Canal Zone-11 LD Vlv	SHUT	______
1LD-104	North Fuel Transfer Canal Zone-10 LD Vlv	SHUT	______
1LD-105	North Fuel Transfer Canal Zone-9 LD Vlv	SHUT	______
1LD-106	North Fuel Transfer Canal Zone-8 LD Vlv	SHUT	______
1LD-107	North Fuel Transfer Canal Zone-7 LD Vlv	SHUT	______
1LD-108	North Fuel Transfer Canal Zone-6 LD Vlv	SHUT	______
1LD-109	North Fuel Transfer Canal Zone-5 LD Vlv	SHUT	______
1LD-110	North Fuel Transfer Canal Zone-4 LD Vlv	SHUT	______
1LD-111	North Fuel Transfer Canal Zone-3 LD Vlv	SHUT	______
1LD-112	North Fuel Transfer Canal Zone-2 LD Vlv	SHUT	______
1LD-113	North Fuel Transfer Canal Zone-1 LD Vlv	SHUT	______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	216 FHB North (continued)		
1LD-114	North New Fuel Pit Gate Zone-1 LD Vlv	SHUT	_______
1LD-115	North New Fuel Pit Zone-1 LD Vlv	SHUT	_______
1LD-116	North New Fuel Pit Sump Zone-2 LD Vlv	SHUT	_______
1LD-117	North New Fuel Pit Zone-3 LD Vlv	SHUT	_______
1LD-118	North New Fuel Pit Zone-4 LD Vlv	SHUT	_______
1LD-119	North New Fuel Pit Zone-5 LD Vlv	SHUT	_______
1LD-120	North New Fuel Pit Zone-6 LD Vlv	SHUT	_______
1LD-121	Cask Loading Pool Gate Zone-1 LD Vlv	SHUT	_______
1LD-122	Cask Loading Pool Zone-1 LD Vlv	SHUT	_______
1LD-123	Cask Loading Pool Zone-2 LD Vlv	SHUT	_______
1LD-124	Cask Loading Pool Zone-3 LD Vlv	SHUT	_______
1LD-125	Cask Loading Pool Zone-4 LD Vlv	SHUT	_______
1LD-126	Fuel Transfer Tube Inspect Area First LD Vlv	SHUT	_______
1LD-127	Fuel Transfer Tube Inspect Area Second LD Vlv	SHUT	_______
1LD-128	RCB Refueling Cavity Zone-8 LD Vlv	SHUT	_______
1LD-129	RCB Refueling Cavity Zone-9 LD Vlv	SHUT	_______
1LD-130	RCB Refueling Cavity Zone-7 LD Vlv	SHUT	_______
1LD-131	RCB Refueling Cavity Zone-6 LD Vlv	SHUT	_______
1LD-132	RCB Refueling Cavity Zone-5 LD Vlv	SHUT	_______
1LD-133	RCB Refueling Cavity Zone-10 LD Vlv	SHUT	_______
1LD-134	RCB Refueling Cavity Zone-4 LD Vlv	SHUT	_______
1LD-135	RCB Refueling Cavity Zone-3 LD Vlv	SHUT	_______
1LD-136	RCB Refueling Cavity Zone-2 LD Vlv	SHUT	_______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	216 FHB North (continued)		
1LD-137	RCB Refueling Cavity Zone-1 LD Vlv	SHUT	______
1LD-138	RCB Refueling Cavity Zone-11 LD Vlv	SHUT	______
	236 FHB		
1LD-22	Main Fuel Transfer Canal Zone-1 LD Vlv South End	SHUT	______
1LD-23	Main Fuel Transfer Canal Zone-2 LD Vlv South End	SHUT	______
1LD-24	Main Fuel Transfer Canal Zone-3 LD Vlv South End	SHUT	______
1LD-25	South Spent Fuel Pool Gate Zone-4 LD Vlv	SHUT	______
1LD-26	Main Fuel Transfer Canal Zone-5 LD Vlv South End	SHUT	______
1LD-27	Main Fuel Transfer Canal Zone-6 LD Vlv South End	SHUT	______
1LD-28	South Spent Fuel Pool Zone-12 LD Vlv	SHUT	______
1LD-29	South Spent Fuel Pool Zone-11 LD Vlv	SHUT	______
1LD-30	South Spent Fuel Pool Zone-10 LD Vlv	SHUT	______
1LD-31	South Spent Fuel Pool Sump Zone-9 LD Vlv	SHUT	______
1LD-32	South Spent Fuel Pool Zone-8 LD Vlv	SHUT	______
1LD-33	South Spent Fuel Pool Zone-7 LD Vlv	SHUT	______
1LD-34	South Spent Fuel Pool Zone-6 LD Vlv	SHUT	______
1LD-35	South Spent Fuel Pool Zone-5 LD Vlv	SHUT	______
1LD-36	South Spent Fuel Pool Zone-4 LD Vlv	SHUT	______
1LD-37	South Spent Fuel Pool Zone-3 LD Vlv	SHUT	______
1LD-38	South Spent Fuel Pool Zone-2 LD Vlv	SHUT	______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	216 FHB North (continued)		
1LD-39	South Spent Fuel Pool Zone-1 LD Vlv	SHUT	______
1LD-40	Main Fuel Transfer Canal Zone-1 LD Vlv Near Col 33	SHUT	______
1LD-41	Main Fuel Transfer Canal Zone-2 LD Vlv Near Col 33	SHUT	______
1LD-42	Main Fuel Transfer Canal Zone-3 LD Vlv Near Col 33	SHUT	______
	236 FHB (continued)		
1LD-43	Main Fuel Transfer Canal Zone-4 LD Vlv Near Col 33	SHUT	______
1LD-44	Main Fuel Transfer Canal Zone-5 LD Vlv Near Col 33	SHUT	______
1LD-45	Main Fuel Transfer Canal Zone-6 LD Vlv Near Col 33	SHUT	______
1LD-46	Main Fuel Transfer Canal Zone-7 LD Vlv Near Col 33	SHUT	______
1LD-47	Main Fuel Transfer Canal Zone-8 LD Vlv Near Col 33	SHUT	______
1LD-48	Main Fuel Transfer Canal Zone-9 LD Vlv Near Col 33	SHUT	______
1LD-49	Main Fuel Transfer Canal Zone-10 LD Vlv Near Col 33	SHUT	______
1LD-50	Main Fuel Transfer Canal Zone-11 LD Vlv Near Col 33	SHUT	______
1LD-51	Main Fuel Transfer Canal Zone-12 LD Vlv Near Col 33	SHUT	______
1LD-52	Main Fuel Transfer Canal Zone-1 LD Vlv Near Col 41	SHUT	______
1LD-53	Main Fuel Transfer Canal Zone-2 LD Vlv Near Col 41	SHUT	______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	216 FHB North (continued)		
1LD-54	Main Fuel Transfer Canal Zone-3 LD Vlv Near Col 41	SHUT	______
1LD-55	Main Fuel Transfer Canal Zone-4 LD Vlv Near Col 41	SHUT	______
1LD-56	Main Fuel Transfer Canal Zone-5 LD Vlv Near Col 41	SHUT	______
1LD-57	Main Fuel Transfer Canal Zone-6 LD Vlv Near Col 41	SHUT	______
	236 FHB (continued)		
1LD-58	Main Fuel Transfer Canal Zone-7 LD Vlv Near Col 41	SHUT	______
1LD-59	Main Fuel Transfer Canal Zone-8 LD Vlv Near Col 41	SHUT	______
1LD-60	Main Fuel Transfer Canal Zone-9 LD Vlv Near Col 41	SHUT	______
1LD-61	Main Fuel Transfer Canal Zone-10 LD Vlv Near Col 41	SHUT	______
1LD-62	Main Fuel Transfer Canal Zone-1 LD Vlv Near Col 45	SHUT	______
1LD-63	Main Fuel Transfer Canal Zone-2 LD Vlv Near Col 45	SHUT	______
1LD-64	Main Fuel Transfer Canal Zone-3 LD Vlv Near Col 45	SHUT	______
1LD-65	Main Fuel Transfer Canal Zone-4 LD Vlv Near Col 45	SHUT	______
1LD-66	Main Fuel Transfer Canal Zone-5 LD Vlv Near Col 45	SHUT	______
1LD-67	Main Fuel Transfer Canal Zone-6 LD Vlv Near Col 45	SHUT	______
1LD-68	Main Fuel Transfer Canal Zone-7 LD Vlv Near Col 45	SHUT	______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	236 FHB (continued)		
1LD-69	Main Fuel Transfer Canal Zone-8 LD Vlv Near Col 45	SHUT	_______
1LD-70	Main Fuel Transfer Canal Zone-9 LD Vlv Near Col 45	SHUT	_______
1LD-71	Main Fuel Transfer Canal Zone-10 LD Vlv Near Col 45	SHUT	_______
1LD-72	Main Fuel Transfer Canal Zone-11 LD Vlv Near Col 45	SHUT	_______
1LD-73	Main Fuel Transfer Canal Zone-12 LD Vlv Near Col 45	SHUT	_______
1LD-74	Main Fuel Transfer Canal Zone-1 LD Vlv Near Col 55	SHUT	_______
1LD-75	Main Fuel Transfer Canal Zone-2 LD Vlv Near Col 55	SHUT	_______
1LD-76	Main Fuel Transfer Canal Zone-3 LD Vlv Near Col 55	SHUT	_______
1LD-77	Main Fuel Transfer Canal Zone-4 LD Vlv Near Col 55	SHUT	_______
1LD-78	Main Fuel Transfer Canal Zone-5 LD Vlv Near Col 55	SHUT	_______
1LD-79	Main Fuel Transfer Canal Zone-6 LD Vlv Near Col 55	SHUT	_______
1LD-80	Main Fuel Transfer Canal Zone-7 LD Vlv Near Col 55	SHUT	_______
1LD-81	Main Fuel Transfer Canal Zone-8 LD Vlv Near Col 55	SHUT	_______
1LD-82	Main Fuel Transfer Canal Zone-9 LD Vlv Near Col 55	SHUT	_______
1LD-83	Main Fuel Transfer Canal Zone-10 LD Vlv Near Col 55	SHUT	_______
1LD-84	Main Fuel Transfer Canal Zone-11 LD Vlv Near Col 55	SHUT	_______

Fuel Pool Cooling and Cleanup System Leak Detection System Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	236 FHB (continued)		
1LD-85	Main Fuel Transfer Canal Zone-12 LD Vlv Near Col 55	SHUT	______
1LD-86	Main Fuel Transfer Canal Zone-4 LD Vlv North End	SHUT	______
1LD-87	North Spent Fuel Pool Gate Zone-3 LD Vlv	SHUT	______
1LD-88	Main Fuel Transfer Canal Zone-2 LD Vlv North End	SHUT	______
1LD-89	Main Fuel Transfer Canal Zone-1 LD Vlv North End	SHUT	______

Fuel Pool Cooling System Startup Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time __________ Date __________

Checklist Completed Time __________ Date __________

Approved by ____________________ Date __________
Unit SCO

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Fuel Pool Cooling System Startup Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train A			
1SF-1	SFP Supply to A Train Isolation	*OPEN/ SHUT	______	______
1SF-8	Fuel Pool Cooling Supply Isol to Spent Fuel Pool	*OPEN/ SHUT	______	______
1SF-9	NFP to A Train Supply Isol	*OPEN/ SHUT	______	______
1SF-7	Fuel Pool Cooling Supply Isol to New Fuel Pool	*OPEN/ SHUT	______	______
1SF-6	1&4A-SA Hx Outlet Isol	THROTTLED	______	______
	Train B			
1SF-11	SFP Supply to B Train Isolation	*OPEN/ SHUT	______	______
1SF-18	Fuel Pool Cooling Supply Isol to Spent Fuel Pool	*OPEN/ SHUT	______	______
1SF-19	NFP to B Train Supply Isol	*OPEN/ SHUT	______	______
1SF-17	Fuel Pool Cooling Supply Isol to New Fuel Pool	*OPEN/ SHUT	______	______
1SF-16	1&4B-SB Hx Outlet	THROTTLED	______	______
1SF-1	SFP Supply to A Train Isolation	OPEN	______	______

* Circle the correct position

Fuel Pool Purification Current System Lineup

SUCTION PATH (Pool, Tank, or Canal) ______________________

Purification Inservice per Section 5.2, 7.2, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.16, 8.17, 8.18, 8.19, 8.20, 8.21, 8.22, S/D
(Circle appropriate Section or S/D if system is shutdown)

PUMP	STATUS (Circle Appropriate Status)
A	Through FILTER, through FILTER and DEMIN, S/D
B	Through FILTER, through FILTER and DEMIN, S/D

DISCHARGE PATH (Pool, Canal, or Tank) ______________________

Comments ______________________

Approved by ______________________ Unit SCO ______________ Date

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Fuel Pool Purification System Startup Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Fuel Pool Purification System Startup Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-22	FPC System Supply Isol to Purification System	*OPEN/ SHUT	______	______
	Train A			
1SF-1	SFP Supply to A Train Isolation	*OPEN/ SHUT	______	______
1SF-21	A Train Supply to Purif Sys	*OPEN/ SHUT	______	______
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pools	*OPEN/ SHUT	______	______
1SF-26	FP Purif System Return Isol A FPC to NFP	*OPEN/ SHUT	______	______
1SF-123	Fuel Pool Purif Pump 1A Disch Isol	THROTTLED	______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	*OPEN/ SHUT	______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	*OPEN/ SHUT	______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass from Pump 1A	*OPEN/ SHUT	______	N/A
1SF-9	NFP to A Train Supply Isolation	*OPEN/ SHUT	______	______
	Train B			
1SF-11	SFP Supply to B Train Isolation	*OPEN/ SHUT	______	______
1SF-19	NFP to B Train Supply Isolation	*OPEN/ SHUT	______	______
1SF-20	1B-SB FPC Supply to Purif Sys	*OPEN/ SHUT	______	______

* Circle the correct position

Fuel Pool Purification System Startup Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train B (continued)			
1SF-28	FP Purif System Return Isol to B FPC to Spent Fuel Pools	*OPEN/ SHUT	_______	_______
1SF-133	Fuel Pool Purif Pump 1B Disch Isol	THROTTLED	_______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	*OPEN/ SHUT	_______	N/A
1SF-27	FP Purif System Return Isol to B FPC to NFP	*OPEN/ SHUT	_______	_______
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	*OPEN/ SHUT	_______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	*OPEN/ SHUT	_______	N/A

* Circle the correct position

Fuel Pool Skimmer Valve Status Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Fuel Pool Skimmer Valve Status Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	NFP A		
1SF-93	Unit 1 NFP Common Skimmer Suction Isol	OPEN	______
1SF-90	Unit 1 NFP Northwest Skimmer Suction Isol	*OPEN/ SHUT	______
1SF-91	Unit 1 NFP North Skimmer Suction Isol	*OPEN/ SHUT	______
1SF-92	Unit 1 NFP NE Skimmer Suct Isol	*OPEN/ SHUT	______
1SF-98	Unit 1 NFP Skimmer Return Isol	THROTTLED	______
	SFP B		
1SF-77	Unit 1 SFP South Skimmer Suct Isol	*OPEN/ SHUT	______
1SF-78	Unit 1 SFP Northeast Skimmer Suct Isol	*OPEN/ SHUT	______
1SF-81	Unit 1 SFP Northwest Skimmer Suct Isol	*OPEN/ SHUT	______
1SF-80	Unit 1 SFP Northwest Skimmer Suct Isol	*OPEN/ SHUT	______
1SF-79	Unit 1 SFP SW Skimmer Suct Isol	*OPEN/ SHUT	______
1SF-87	Skimmer Return Isol to Unit 1 SFP	THROTTLED	______
1SF-82	Unit 1 SFP Common Skimmer Suct Isolation	OPEN	______

* Circle the correct position

Fuel Pool Skimmer Valve Status Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	Main Transfer Canal		
1SF-89	Main Xfer Canal South Skimmer Suct Isol	*OPEN/SHUT	______
1SF-88	Skimmer Return Isol to Main Fuel Xfer Canal	THROTTLED	______
	Fuel Transfer Canal Unit 1		
1SF-94	Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol	*OPEN/SHUT	______
1SF-95	Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol	*OPEN/SHUT	______
1SF-96	Fuel Xfer Canal to Skimmer Pumps Isol	OPEN	______
1SF-97	Unit 1 Fuel Xfer Canal Skimmer Return Isol	THROTTLED	______
	Fuel Transfer Canal Unit 2		
2SF-94	Suction to Fuel Transfer Canal Unit 2	*OPEN/SHUT	______
2SF-95	Suction to Fuel Transfer Canal Unit 2	*OPEN/SHUT	______
1SF-99	Skimmer Pumps A&B X-tie Isol	OPEN	______
1SF-100	Skimmer Pumps A&B Disc X-tie	OPEN	______
2SF-97	Fuel Transfer Canal Inlet Isol	THROTTLED	______
	Cask Loading Pool		
2SF-100	Cask Loading Pool Skimmer Outlet Isol	*OPEN/SHUT	______
2SF-99	Skimmer Return to Cask Loading Pool (Units 1&2)	THROTTLED	______

* Circle the correct position

Fuel Pool Purification Shutdown Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ______ Date ______

Checklist Completed Time ______ Date ______

Approved by ______________________ Date ______
Unit SCO

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Fuel Pool Purification Shutdown Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section A	Spent/New Fuel Pool			
1SF-20	1B-SB FPC Supply to Purif Sys	SHUT	______	N/A
1SF-21	A Train Supply to Purif Sys	SHUT	______	N/A
1SF-22	FPC System supply Isol to Purification System	SHUT	______	N/A
1SF-28	FP Purif Sys Return Isol to B FPC to Spent Fuel Pools	SHUT	______	N/A
1SF-29	FP Purif Sys Return Isol to A FPC to Spent Fuel Pools	SHUT	______	N/A
1SF-26	FP Purif System Return Isol to A FPC to NFP	SHUT	______	N/A
1SF-27	FP Purif System Return Isol to B FPC to NFP	SHUT	______	N/A
Section B	Cask Loading Pool			
2SF-199	Cask Loading Pools to Fuel Pool Purif Suct	SHUT	______	N/A
2SF-200	Cask Loading Pool to Fuel Pool Purif Suct	SHUT	______	N/A
1SF-203	FPP Sys Common Sup Header From Unit 2 and 3 and Cask PL	SHUT	______	N/A
1SF-206	Fuel Pool Purif Return Isol to Unit 2&3	SHUT	______	N/A
2SF-205	Fuel Pool Purif to Cask Loading Pool	LOCKED SHUT	______	N/A
2SF-188	Fuel Pool Purif Supply Isol To Cask Loading Pool	SHUT	______	N/A
2SF-203	Fuel Pool Purif Supply To Cask Loading Pool	SHUT	______	N/A

Fuel Pool Purification Shutdown Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section B	Cask Loading Pool (continued)			
2SF-141	Fuel Pool Purif Supply To Cask Loading Pool	LOCKED SHUT	______	N/A
1SF-202	SFP Supply Isol to Fuel Pool Purif Sys	OPEN	______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	OPEN	______	N/A
Section C	Unit 1 Fuel Transfer Canal to SFP B			
1SF-146	Unit 1 Fuel Xfer Canal East Drain Isol	SHUT	______	N/A
1SF-147	Unit 1 Fuel Xfer Canal West Drain Isol	SHUT	______	N/A
1SF-148	Transfer Canal A Supply Isol To Purification System	SHUT	______	N/A
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pools	SHUT	______	N/A
Section D	Main Transfer Canal			
1SF-196	Fuel Xfer Canal NW Supply Isol to Fuel Pool Purif	SHUT	______	N/A
1SF-197	Fuel Xfer Canal N Supply Isol To Fuel Pool Purif	SHUT	______	N/A
1SF-198	Fuel Xfer Canal NE Supply Isol To Fuel Pool Purif	SHUT	______	N/A
1SF-200	Fuel Xfer Canal Supply To Fuel Pool Purif Sys Comm	SHUT	______	N/A
1SF-29	FP Purif System Return Isol to A FPC To Spent Fuel Pools	SHUT	______	N/A

Fuel Pool Purification Shutdown Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section E	RWST Purification			
1CT-23	RWST to SFP Pump Suction	SHUT	______	______
1SF-193	RWST Supply Isol to FP Purif Sys	SHUT	______	N/A
1SF-187	Fuel Pool Purif Return to RWST	SHUT	______	N/A
1SF-202	SFP Supply Isol to FP Purif Sys	OPEN	______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	OPEN	______	N/A
Section F	Refueling Cavity			
1SF-118	Refuel Cavity Purification Suct CIV	LOCKED SHUT	______	______
1SF-145	Refueling Cavity Purification Discharge CIV (IRC)	LOCKED SHUT	______	______
1SF-119	Refuel Cavity Purification Suction CIV (ORC)	LOCKED SHUT	______	______
1SF-144	Refueling Cavity Purification Discharge CIV(ORC)	LOCKED SHUT	______	______
1SF-120	Unit 1 Refuel Cavity to Fuel Pool Purif Pumps 1A & 1B	SHUT	______	N/A
1SF-143	Fuel Pool Purif Sys A Supply to Refuel Cavity	SHUT	______	N/A
1SF-212	Unit 1 Refuel Cav Purif Suct Isol	SHUT	______	N/A
1SF-202	SFP Supply Isol to FP Purif Sys	OPEN	______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	OPEN	______	N/A
1SF-210	Unit 1 Refuel Cavity Purif Return	SHUT	______	N/A

Fuel Pool Purification Shutdown Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section G	Purification Pumps (Circle Correct Position)			
1SF-130	Fuel Pool Demin A Outlet to FT-5154A	OPEN/ SHUT	_______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	OPEN/ SHUT	_______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	OPEN/ SHUT	_______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	OPEN/ SHUT	_______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass From Pump A	OPEN/ SHUT	_______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump B	OPEN/ SHUT	_______	N/A
Section H	Cask Loading and Unit 2 Xfer Canal Purification			
2SF-199	Cask Loading Pools to Fuel Pool Purif Suct	SHUT	_______	N/A
2SF-200	Cask Loading Pool to Fuel Pool Purif Suct	SHUT	_______	N/A
1SF-203	FPP Sys Common Sup Header From Unit 2 and 3 and Cask PL	SHUT	_______	N/A
2SF-146	Unit 2 Fuel Xfer Canal East Drain to Purification System	SHUT	_______	N/A
2SF-147	Unit 2 Fuel Xfer Canal West Drain to Purification System	SHUT	_______	N/A
2SF-148	Unit 2&3 Supply Isol to Fuel Pool Purif Sys A	SHUT	_______	N/A
1SF-29	FP Purif System Return Isol to A FPC to Spent Fuel Pool	SHUT	_______	N/A

Fuel Pool Purification Shutdown Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section I	Unit 1 Fuel Transfer Canal Drain Valves			
1SF-146	Unit 1 Fuel Transfer Canal East Drain Isol	SHUT	_______	N/A
1SF-147	Unit 1 Fuel Transfer Canal West Drain Isol	SHUT	_______	N/A
1SF-148	Transfer Canal A Supply Isol to Purification System	SHUT	_______	N/A
Section J	Unit 1 Transfer Canal Return			
1SF-192	Fuel Pool Purification System Return to Transfer Canal A	SHUT	_______	N/A

Fuel Pool Purification Shutdown Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section K	Fuel Pool Purification			
NOTE:	If valve was not used N/A check.			
1SF-187	Fuel Pool Purif Return to RWST	SHUT	______	N/A
1SF-189	Fuel Pool Purif Return to SFP Downstream 1SF-141	SHUT	______	N/A
1SF-26	FP Purif Sys Return Isol to A FPC to NFP	SHUT	______	______
1SF-27	FP Purif Sys Return Isol to B FPC to NFP	SHUT	______	______
1SF-28	FP Purif Sys RTN Isol to B FPC to Spent Fuel Pool	SHUT	______	______
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pool	SHUT	______	______
1SF-192	Fuel Pool Purif Sys Return to Xfer Canal A	SHUT	______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	SHUT	______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	SHUT	______	______
1SF-126	Fuel Pool Purif Demin Filter 1A Supply to 1 Demin	SHUT	______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	SHUT	______	N/A
1SF-194	Reactor Cool Dr Tk Supply to Fuel Pool Purif Sys	SHUT	______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	OPEN	______	N/A
1SF-202	SFP Supply Isol to Fuel Pool Purif Sys	OPEN	______	N/A

Fuel Pool Skimmer Shutdown Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Fuel Pool Skimmer Shutdown Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	SHUTDOWN/SUCTION		
	NFP A		
1SF-90	Unit 1 NFP Northwest Skimmer Suction Isol	SHUT	_______
1SF-91	Unit 1 NFP North Skimmer Suction Isol	SHUT	_______
1SF-92	Unit 1 NFP NE Skimmer Suct Isol	SHUT	_______
1SF-93	Unit 1 NFP Common Skimmer Suct Isolation	SHUT	_______
	SFP B		
1SF-77	Unit 1 SFP South Skimmer Suct Isol	SHUT	_______
1SF-78	Unit 1 SFP Northeast Skimmer Suct Isol	SHUT	_______
1SF-81	Unit 1 SFP Northwest Skimmer Suct Isol	SHUT	_______
1SF-80	Unit 1 SFP Northwest Skimmer Suct Isol	SHUT	_______
1SF-79	Unit 1 SFP SW Skimmer Suct Isol	SHUT	_______
	Main Transfer Canal		
1SF-89	Main Xfer Canal South Skimmer Suct Isol	SHUT	_______

Fuel Pool Skimmer Shutdown Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	Fuel Transfer Canal Unit 1		
1SF-94	Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol	SHUT	______
1SF-95	Unit 1 Fuel Xfer Canal Southeast Skimmer Suct Isol	SHUT	______
	Unit 2 Fuel Transfer Canal		
2SF-94	Suction to Fuel Transfer Canal Unit 2	SHUT	______
2SF-95	Suction to Fuel Trans Canal Unit 2	SHUT	______
	Cask Loading Pool		
2SF-100	Cask Loading Pool Skimmer Outlet Isol	SHUT	______
1SF-99	Skimmer Pumps A&B X-tie Isol	LOCKED SHUT	______
	SHUTDOWN/DISCHARGE		
	NFP A		
1SF-98	Unit 1 NFP Skimmer Return Isol	SHUT	______
	SFP B		
1SF-87	Skimmer Return Isol to Unit 1 SFP	SHUT	______
	Main Transfer Canal		
1SF-88	Skimmer Return Isol to Main Fuel Xfer Canal	SHUT	______
	Unit 1 Fuel Transfer Canal		
1SF-97	Unit 1 Fuel Xfer Canal Skimmer Return Isol	SHUT	______

Fuel Pool Skimmer Shutdown Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
	Fuel Transfer Canal Unit 2		
2SF-97	Fuel Transfer Canal Inlet Isol	LOCKED SHUT	_______
	Cask Loading Pool		
2SF-99	Skimmer Return to Cask Loading Pool (Units 1&2)	SHUT	_______
1SF-100	Skimmer Pumps A&B Disc X-tie	LOCKED SHUT	_______

Fuel Pool Cooling Fill and Vent Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ________________________________ Date ____________
Unit SCO

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Fuel Pool Cooling Fill and Vent Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-37	FPC Pump 1&4A-SA Casing Vent	SHUT & CAPPED	______	______
1SF-43	1&4A-SA Heat Exchanger Tube Side Vent Isol	SHUT & CAPPED	______	______
1SF-59	1&4B-SB Fuel Pool Cooling Pump Casing Vent	SHUT & CAPPED	______	______
1SF-67	Fuel Pool 1&4B-SB Heat Exchanger Tube Side Vent	SHUT & CAPPED	______	______
1SF-221	Fuel Pool Cooling Supply to Purif Sys Vent Isol	SHUT & CAPPED	______	______
1SF-222	New Fuel Pool to B Train Vent Isol	SHUT & CAPPED	______	______
1SF-223	NFP and SFP to B Train Vent Isolation	SHUT & CAPPED	______	______
1SF-224	SFP to A Train Vent	SHUT & CAPPED	______	______
1SF-4	FPC Pump 1&4A-SA Disch Isol	OPEN	______	______
1SF-14	1&4B Fuel Pool Cooling Pump Disch Isol	OPEN	______	______

Fuel Pool Purification Fill and Vent Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ______ Date ______

Checklist Completed Time ______ Date ______

Approved by ______________________ Date ______
Unit SCO

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Fuel Pool Purification Fill and Vent Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-171	Fuel Pool Demineralizer A Vent Isol	SHUT & CAPPED	______	N/A
1SF-172	Fuel Pool Demineralizer A Vent Isol	SHUT	______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	SHUT	______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	SHUT	______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	SHUT	______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	SHUT	______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass from Pump 1A	SHUT	______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	______	N/A
1SF-28	FP Purif Sys Ret Isol to B FPC to Spent Fuel Pools	SHUT	______	______
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pool	SHUT	______	______
1SF-22	FPC System Supply Isol to Purification System	SHUT	______	______
1SF-21	A Train Supply to Purif Sys	SHUT	______	______
1SF-20	1B-SB FPC Supply to Purif Sys	SHUT	______	______

Fuel Pool Skimmer System Fill and Vent Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

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Fuel Pool Skimmer System Fill and Vent Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-220	Fuel Pools Skimmer Pmp Strainer 1&4X-NNS Vent Vlv	SHUT & CAPPED	______	N/A
1SF-110-DV 1	Fuel Pool Skimmer Pump A Inst Vent to PI-5111	SHUT	______	N/A
1SF-83	Fuel Pool Skimmer Pump A Suction Isol	OPEN	______	N/A
1DW-527	DW Iso to Fuel Pools Skimmer Pmp Strainer 1&4X-NNS	LOCKED SHUT	______	______

Makeup to Fuel Pools, Transfer Canals and Cask Loading Pool Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
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Makeup to Fuel Pools, Transfer Canals and Cask Loading Pool Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
Section 8.4				
1SF-201	Demin WT Supply Isol to Fuel Pool Purif	LOCKED SHUT	______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass From Pump 1A	SHUT	______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	______	N/A
Section 8.5				
1SF-202	SFP Supply Isol to Fuel Pool Purif Sys	OPEN	______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass From Pump 1A	SHUT	______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	______	N/A
	RWST Supply			
1SF-193	RWST Supply Isol to Fuel Pool Purification System	SHUT	______	N/A
1CT-23	RWST to SFP Pump Suction	SHUT	______	______
1SF-152	Fuel Pool Purif Pump 1A Suct Isol After ST SF-S6	SHUT & CAPPED	______	N/A
1SF-162	Fuel Pool Pump Purif 1B Suct Isol After ST SF-S5	SHUT & CAPPED	______	N/A
	Demin Supply			
1SF-201	Demin WT Supply Isol to Fuel Pool Purif	LOCKED SHUT	______	N/A
	Unit 1 SFP			
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pool	SHUT	______	______
1SF-28	FP Purif Sys Ret Isol to B FPC to Spent Fuel Pools	SHUT	______	______

Makeup to Fuel Pools, Transfer Canals, and Cask Loading Pool Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Unit 1 NFP			
1SF-26	FP Purif System Return Isol to A FPC to NFP	SHUT	______	______
1SF-27	FP Purif System Return Isol to B FPC to NFP	SHUT	______	______
	Unit 1 Fuel Xfer Canal			
1SF-192	Fuel Pool Purif Sys Return to Xfer Canal A	SHUT	______	N/A
	Cask Loading Pool			
1SF-206	Fuel Pool Purif Return Isol to Unit 2&3	SHUT	______	N/A
2SF-205	Fuel Pool Purif to Cask Loading Pool	LOCKED SHUT	______	N/A
2SF-141	Fuel Pool Purif Supply to Cask Loading Pool	LOCKED SHUT	______	N/A
2SF-188	Fuel Pool Purif Supply Isol to Cask Loading Pool	SHUT	______	N/A
2SF-203	Fuel Pool Purif Supply to Cask Loading Pool	SHUT	______	N/A
Section 8.6				
1DW-527	DW Isol to Fuel Pool Skimmer Pmp Strainer 1&4X-NNS	LOCKED SHUT	______	______
Section 8.26	RMWST Supply			
1PM-150	Reactor Make-up Water to Spent Fuel Pools.	LOCKED SHUT	______	N/A
3PM-83	RMW to BRS Evap 1&2B Cond Demin Isol Vlv.	SHUT	______	N/A
1PM-81	RMW to BRS Evap 1&2A Cond Demin Isol Vlv.	SHUT	______	N/A
1SF-194	Reactor Coolant Dr Tk Supply to Fuel Pool Purif Sys	SHUT	______	N/A

Refueling Cavity Purification Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

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Refueling Cavity Purification Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-201	Demin WT Supply Isol to Fuel Pool Purif	LOCKED SHUT	_______	N/A
1SF-202	SFP Supply Isol to FP Purif Sys	SHUT	_______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	SHUT	_______	N/A
1SF-118	Refuel Cavity Purif Suction CIV (IRC)	OPEN	_______	_______
1SF-145	Refueling Cavity Purification Disch CIV(IRC)	OPEN	_______	_______
1SF-119	Refuel Cavity Purification Suction CIV (ORC)	OPEN	_______	_______
1SF-212	Unit 1 Refuel Cav Purif Suct Isol	OPEN	_______	N/A
1SF-144	Refueling Cavity Purification Discharge CIV(ORC)	OPEN	_______	_______
1SF-210	Unit 1 Refuel Cavity Purif Return	OPEN	_______	N/A
1SF-120	Unit 1 Refuel Cavity to Fuel Pool Purif Pumps 1A & 1B	OPEN	_______	N/A
1SF-143	Fuel Pool Purif Sys A Supply to Refuel Cavity	OPEN	_______	N/A
	<u>Train A</u>			
1SF-123	Fuel Pool Purif Pump 1A Disch Isol	THROTTLED	_______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	OPEN	_______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	OPEN	_______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass from Pump A	SHUT	_______	N/A

Refueling Cavity Purification Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train B			
1SF-133	Fuel Pool Purif Pump 1B Disch Isol	THROTTLED	_______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	OPEN	_______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	OPEN	_______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	_______	N/A

Transfer Canal, Refueling Cavity, Cask Loading Pool, Drain Valve Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ________________________________ Date ____________
Unit SCO

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Transfer Canal, Refueling Cavity, Cask Loading Pool, Drain Valve Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-118	Refuel Cavity Purification Suction CIV (IRC)	LOCKED SHUT	______	______
1SF-119	Refuel Cavity Purification Suction CIV (ORC)	LOCKED SHUT	______	______
1SF-202	SFP Supply Isol to FP Purif Sys	OPEN	______	N/A
1SF-191	Fuel Pool Purif Return to SFP Dnstream 1SF-205	OPEN	______	N/A
1SF-186	Refueling Cavity Drain Isol to Cont Floor	SHUT	______	N/A
1SF-121	Fuel Pool Purification Pump 1A Suction Isol	OPEN	______	N/A
1SF-131	Fuel Pool Purification Pump 1B Isol	OPEN	______	N/A
1SF-146	Unit 1 Fuel Xfer Canal East Drain Isol	SHUT	______	N/A
1SF-147	Unit 1 Fuel Xfer Canal West Drain Isol	SHUT	______	N/A
1SF-120	Unit 1 Refuel Cavity to Fuel Pool Purif Pumps 1A & 1B	SHUT	______	N/A
1SF-148	Transfer Canal A Supply Isolation To Purification System	SHUT	______	N/A

Fuel Transfer Canals and Cask Loading Pool Fill Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Fuel Transfer Canals and Cask Loading Pool Fill Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-1	SFP Supply to A Train Isolation	OPEN	______	______
1SF-5	Fuel Pool Hx 1&4A-SA Inlet Isol	OPEN	______	______
1SF-24	A Train Supply to Xfer Canal Isol	SHUT	______	______
1SF-23	FPC Sys Supply Fill Isol to Transfer Canal U-1&4	SHUT	______	______
1SF-9	NFP to A Train Supply Isol	SHUT	______	______
1SF-10	RWST to A Supply Isol	SHUT	______	______

Emergency Makeup to Fuel Pools from ESW

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

Approved by ______________________ Date ________
Unit SCO

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Emergency Makeup to Fuel Pools from ESW

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1CT-23	RWST to SFP Pump Suction	SHUT	______	______
1SF-76	SFPCCS Emerg Makeup Conn Vent Vlv	SHUT & CAPPED	______	______
1SW-1239	DG 1B SW Return Hdr SFCW Emerg M/U Conn	SHUT & CAPPED	______	______
1SW-269	DG 1A SW Return Hdr SFCW Emerg M/U Backup Conn	SHUT & CAPPED	______	______
1SF-10	RWST to A Supply Isol	SHUT	______	______

Unit 1 Fuel Pool and Fuel Transfer Canal Recirculation Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Unit 1 Fuel Pool and Fuel Transfer Canal Recirculation Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train A			
1SF-1	SFP Supply to A Train Isolation	OPEN	______	______
1SF-5	Fuel Pool Hx 1&4A-SA Inlet Isol	*OPEN/SHUT	______	______
1SF-24	A Train Supply to Xfer Canal Isol	*OPEN/SHUT	______	______
1SF-2	FPC Pump 1&4A-SA Suction Isol	OPEN	______	______
1SF-9	NFP to A Train Supply Isolation	*OPEN/SHUT	______	______
	Train B			
1SF-11	SFP Supply to B Train Isolation	OPEN	______	______
1SF-15	1&4B-SB Heat Exchanger Inlet	*OPEN/SHUT	______	______
1SF-25	1B-SB FPC Supply to Transfer Canal	*OPEN/SHUT	______	______
1SF-12	1&4B-SB Fuel Pool Cooling Pump Suction Isol	OPEN	______	______
1SF-23	FPC Sys Supply Fill Isol to Transfer Canal U-1&4	*THROTTLED/ SHUT	______	______
1SF-19	NFP to B Train Supply Isolation	*OPEN/SHUT	______	______

* Circle the correct position

Mode 6 Fuel Pool Cooling and Cleanup System Lineup to Prevent Dilution During Refueling

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

Approved by ______________________________ Date ________
Unit SCO

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Mode 6 Fuel Pool Cooling and Cleanup System Lineup to Prevent Dilution During Refueling

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
1DW-29	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-30	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-31	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-32	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-33	Demin Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-35	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-36	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-37	Demin Wtr Fuel Pool Vlv Box Conn Isol	LOCKED SHUT	_______
1DW-38	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-39	Dem Wtr Fuel Pool Vlv Box Conn Isol Vlv	LOCKED SHUT	_______
1DW-527	DW Iso to Fuel Pools Skimmer Pmp Strainer 1&4X-NNS	LOCKED SHUT	_______
1SF-201	Demin Water Supply Isol to Fuel Pool Purif	LOCKED SHUT	_______
2SF-23	FPC Sys Supply Fill Isol to Transfer Canal U-2&3	LOCKED SHUT	_______

Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

Approved by ________________ Date ________
Unit SCO

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Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train A			
1SF-123	Fuel Pool Purif Pump 1A Disch Isol	THROTTLED	______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	OPEN	______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	OPEN	______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass from Pump 1A	SHUT	______	N/A
	Train B			
1SF-133	Fuel Pool Purif Pump 1B Disch Isol	THROTTLED	______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	OPEN	______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	OPEN	______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass from Pump 1B	SHUT	______	N/A
2SF-199	Cask Loading Pools to Fuel Pool Purif Suct	OPEN	______	N/A
2SF-200	Cask Loading Pool to Fuel Pool Purif Suct	OPEN	______	N/A
1SF-203	FPP Sys Common Sup Header from Unit 2 and 3 and Cask PL	OPEN	______	N/A
2SF-146	Unit 2 Fuel Xfer Canal East Drain to Purification System	OPEN	______	N/A

Cask Loading Pool and Unit 2 Fuel Transfer Canal Purification Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train B(continued)			
2SF-147	Unit 2 Fuel Xfer Canal West Drain to Purification System	OPEN	______	N/A
2SF-148	Unit 2&3 Supply Isol to Fuel Pool Purif Sys A	OPEN	______	N/A
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pool	OPEN	______	______

Main Fuel Transfer Canal Purification Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Main Fuel Transfer Canal Purification Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
	Train A			
1SF-123	Fuel Pool Purif Pump 1A Disch Isol	THROTTLED	______	N/A
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	OPEN	______	N/A
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	OPEN	______	N/A
1SF-127	Fuel Pool Purif Demin A Bypass from Pump 1A	SHUT	______	N/A
	Train B			
1SF-133	Fuel Pool Purif Pump 1B Disch Isol	THROTTLED	______	N/A
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	OPEN	______	N/A
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	OPEN	______	N/A
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	______	N/A
1SF-196	Fuel Xfer Canal NW Supply Isol to Fuel Pool Purif	OPEN	______	N/A
1SF-197	Fuel Xfer Canal N Supply Isol to Fuel Pool Purif	OPEN	______	N/A
1SF-198	Fuel Xfer Canal NE Supply Isol to Fuel Pool Purif	OPEN	______	N/A
1SF-200	Fuel Xfer Canal Supply to Fuel Pool Purif Sys Comm	OPEN	______	N/A
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel pool	OPEN	______	______

Recirculation of SFP B and Transfer Canal by Purification System Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ________________________________ Date ____________
Unit SCO

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Recirculation of SFP B and Transfer Canal by Purification System Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK
1SF-146	Unit 1 Fuel Xfer Canal East Drain Isol	*OPEN/SHUT	_______
1SF-147	Unit 1 Fuel Xfer Canal West Drain Isol	*OPEN/SHUT	_______
1SF-148	Transfer Canal A Supply Isol to Purif Sys	*OPEN/SHUT	_______
	Train A		
1SF-29	FP Purif Sys Ret Isol to A FPC to Spent Fuel Pool	*OPEN/SHUT	_______
1SF-123	Fuel Pool Purif Pump 1A Disch Isol	THROTTLED	_______
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	*OPEN/SHUT	_______
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	*OPEN/SHUT	_______
1SF-127	Fuel Pool Purif Demin A Bypass from Pump 1A	SHUT	_______
	Train B		
1SF-28	FP Purif Sys Ret Isol to B FPC to Spent Fuel Pools	*OPEN/SHUT	_______
1SF-133	Fuel Pool Purif Pump 1B Disch Isol	THROTTLED	_______
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	*OPEN/SHUT	_______
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	*OPEN/SHUT	_______
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	_______

* Circle the correct position

Securing from Purification Demin Rinse Purification Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ______ Date ______

Checklist Completed Time ______ Date ______

Approved by ______________________ Date ______
Unit SCO

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Securing from Purification Demin Resin Change and Rinse Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-128	Fuel Pool Purif Demin A Inlet Isol	OPEN	_______	N/A
1SF-129	Fuel Pool Purif Demin A Outlet Isol	OPEN	_______	N/A
1SF-172	Fuel Pool Demineralizer A Vent Isol	SHUT	_______	N/A
1SF-171	Fuel Pool Demineralizer A Vent Isol	SHUT & CAPPED	_______	N/A
1SF-174	Fuel Pool Demin A Resin Fill Vlv	SHUT	_______	N/A
1SF-173	Fuel Pool Demineralizer A Resin Fill	SHUT & FLANGED	_______	N/A
1SF-20	1B-SB FPC Supply to Purif Sys	SHUT	_______	_______
1SF-21	A Train Supply to Purif Sys	SHUT	_______	_______
1SF-22	FPC System Supply Isol to Purif Sys	SHUT	_______	_______
1SF-130	Fuel Pool Purif Demin A Outlet to FT-5154A	SHUT	_______	_______
1SF-126	Fuel Pool Purif Filter 1A Supply to 1 Demin	SHUT	_______	_______
1SF-139	Fuel Pool Purif Demin A Outlet to FT-5154B	SHUT	_______	_______
1SF-136	Fuel Pool Purif Filter 1B Supply to Demin A	SHUT	_______	_______
1SF-188	Fuel Pool Purif Return Isolation	SHUT	_______	_______
1SF-202	SFP Supply Isol to Fuel Pool Purif Sys	OPEN	_______	_______
1SF-149	Fuel Pool Purif Sys Supply Isol	OPEN	_______	_______
1SF-205	Fuel Pool Purif Return Isol to Fuel Pools	OPEN	_______	_______
1SF-127	Fuel Pool Purif Demin A Bypass From Pump 1A	SHUT	_______	_______
1SF-137	Fuel Pool Purif Demin A Bypass From Pump 1B	SHUT	_______	_______

Securing from Purification Demin Resin Change and Rinse Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-177	Fuel Pool Demineralizer A Disc Header Drain Isol	SHUT	______	N/A
1SF-201	Demin WT Supply Isol to Fuel Pool Purif	LOCKED SHUT	______	N/A

Securing from Filling Refueling Cavity from RWST Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Securing from Filling Refueling Cavity from RWST Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-118	Refueling Cavity Purification Suct CIV (IRC)	LOCKED SHUT	______	______
1SF-150	Fuel Pool Purif Pumps 1A & 1B Suct X Tie	OPEN	______	N/A
1SF-121	Fuel Pool Purif Pump 1A Suction Isol	OPEN	______	N/A
1SF-193	RWST Supply Isol to Fuel Pool Purif Sys	SHUT	______	N/A
1SF-120	Unit 1 Refuel CAV to Fuel Pool Purif Pumps 1A & 1B	SHUT	______	N/A
1SF-212	Unit 1 Refuel Cav Purif Suction Isol	SHUT	______	N/A
1SF-119	Refueling Cavity Purification Suction CIV (ORC)	LOCKED SHUT	______	______
1CT-23	RWST to SFP Pump Suction Vlv	SHUT	______	______

Securing from Transferring Water from RCDT to RWST Lineup Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ____________ Date ____________

Checklist Completed Time ____________ Date ____________

Approved by ______________________________ Date ____________
Unit SCO

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Securing from Transferring Water from RCDT to RWST Lineup Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION	CHECK	VERIFY
1SF-202	SFP Supply Isol to Fuel Pool Purif Sys	OPEN	______	N/A
1SF-131	Fuel Pool Purification Pump 1B Isolation	OPEN	______	N/A
1SF-121	Fuel Pool Purification Pump 1A Suction Isol	OPEN	______	N/A
1SF-193	RWST Supply Isol to Fuel Pool Purif Sys	SHUT	______	N/A
1SF-194	Reactor Cool Dr TK Supply to Fuel Pool Purif Sys	SHUT	______	N/A
1CT-23	RWST to SFP Pump Suction	SHUT	______	______

RWST Addition Manual Calculation Sheet

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ______ Date ______

Checklist Completed Time ______ Date ______

Approved by ______________________ Date ______
Unit SCO

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RWST Addition Manual Calculation Sheet

Obtain the following data:

1. Initial RWST Volume V_1 = _____ GAL
2. Initial RWST Boron Concentration C_1 = _____ PPM
3. Volume of Water to be Added V_2 = _____ GAL

NOTE: Boron concentration of water to be added is the most limiting value of the source or the demineralizer effluent.

4. Boron Concentration of Water to be Added C_2 = _____ PPM

Calculate the final Volume of the RWST:

V_3 = ________(V_1) + ________(V_2)

V_3 = _____ GAL
Performed ________
Verified ________

Calculate the final Concentration of the RWST:

$$C_3 = \frac{[\_\_\_\_\_(C_1) \times \_\_\_\_\_(V_1)] + [\_\_\_\_\_(C_2) \times \_\_\_\_\_(V_2)]}{\_\_\_\_\_(V_3)}$$

C_3 = _____ PPM
Performed ________
Verified ________

Check that the final calculated concentration of the RWST (C_3) is greater than the minimum Tech Spec limit of 2400 PPM boron. If the final concentration if less than the minimum Tech Spec limit for RWST boron, do not make the addition.

____

Fuel Pool Gate Installation and Removal Checklist

Person(s) Performing Checklist

Initials	Name (Print)	Initials	Name (Print)

Remarks - Indicate any component not in the prescribed position.

Checklist Started Time ________ Date ________

Checklist Completed Time ________ Date ________

Approved by ______________________________ Date ________
Unit SCO

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Fuel Pool Gate Installation and Removal Checklist

COMPONENT NUMBER	COMPONENT DESCRIPTION	POSITION (Circle one)	CHECK
1SF-E001	Main Fuel Transfer Canal (Unit 1)	Installed/inflated Installed/deflated Removed	______
1SF-E002	Main Fuel Xfer Canal to Spent Fuel Pool (Unit 1)	Installed/inflated Installed/deflated Removed	______
1SF-E003	Fuel Transfer Canal to Spent Fuel Pool (Unit 1)	Installed/inflated Installed/deflated Removed	______
1SF-E004	New Fuel Pool (Unit 1)	Installed/inflated Installed/deflated Removed	______
1SF-E005	Main Fuel Transfer Canal (Unit 2)	Installed/inflated Installed/deflated Removed	______
1SF-E006	Main Fuel Xfer Canal to Spent Fuel Pool (Unit 2)	Installed/inflated Installed/deflated Removed	______
1SF-E007	Fuel Transfer Canal TO Spent Fuel Pool (Unit 2)	Installed/inflated Installed/deflated Removed	______
1SF-E008	Cask Loading Pool	Installed/inflated Installed/deflated Removed	______
1SF-E009	New Fuel Pool (Unit 2)	Installed/inflated Installed/deflated Removed	______

Revision Summary

General

This revision adds a Section and Attachment for guidance on installing or removing Fuel Pool Gates in response to AR 00007977. It changes Section 8.11 direction on removing a flange to having Maintenance remove it per AR 00003143. Changed position for 1SF-185 to locked for consistency with GP-009. Deleted three valves that were in OP-120.02.38. Additional minor changes made to address DCFs on file.

Description of Changes

Page	Section	Change Description
All		Increased revision level to 16.
1	Cover	Added Reference Use to upper right hand corner.
3	TOC	Added Section 8.27 for control of the fuel pool gates.
4		New attachment to track fuel pool gates.
5	2.1	Deleted procedure titles per AP-005. Added CM-M0118.
43	8.11.2	Modified Step 12 to have Maintenance remove the flange.
78	8.26	Modified Step 8.26.1.1 to remove requirement that the purification system was in service, but only had to be aligned. (DCF 1999P2506) Deleted Step to document per Attachment 13. No Independent Verification is required for the components manipulated, and the procedure section restores all valves to normal lineup, so no value was added by the documentation. (DCF 1999P1978)
99	Attachment 2	Deleted three nitrogen valves that were already contained in another procedure. (DCF 1999P2060)
102		Changed position for 1SF-185 to "locked" shut to be consistent with GP-009.
172	Attachment 27	New Attachment to document gate positions.

Revision 17

Admin Correction on pgs. 54 and 55 to correct train designations in steps 8.16.2.9, 8.16.2.11, and 8.16.2.12.