c) Containment pressure is equal to the saturation pressure of the containment sump water, as discussed in Subsection 6.2.2.

d) The calculation of piping pressure drop and conversion from psi to feet of water is based on a containment sump water density of 59.1 lb/ft^3.

e) Containment sump water level at elevation 21'-3".

f) HPSI pump suction nozzles are located at elevation -6.64 ft.

The available NPSH for the HPSI pumps, operating at the system runout flow of 685 gpm, is approximately 23.5 ft. The calculated value for available NPSH includes conservatism such that acceptable margin exists between the available NPSH and the NPSH required at pump runout. The NPSH required is determined from pump test curves furnished by the manufacturer.

The required NPSH of the St Lucie 2 ECCS pumps has been confirmed by test, in accordance with the ASME Power Test Code 8.2 (centrifugal pumps).

Similar pumps were also supplied for St Lucie Unit 1. Each of the St Lucie Unit 1 pumps were also tested for the NPSH required. The results (see Table 6.3-23) show little variance between pumps for similar flow. The HPSI pumps were tested to produce NPSH at effectively zero percent degradation.

The NPSH vs flow curves for the HPSI pumps are shown on Figures 6.3-4a and 6.3-4b. HPSI and LPSI pump descriptions, including runout flow, are provided in Table 6.3-1.

Mechanical shaft seals are used and are provided with connections to collect any leakage past the seals. The HPSI pump motors are specified to have the capability of starting and accelerating the driven equipment, under load, to design point running speed within eight seconds based on an initial voltage of 75 percent of the rated voltage at the motor terminals. The HPSI pumps are provided with minimum flow protection to prevent damage resulting from operation against a closed discharge. The design temperature is based on the saturation temperature of the reactor coolant at the containment design pressure plus a design tolerance. The design pressure for the high pressure pumps is based on the shutoff head plus maximum containment pressure plus a design tolerance. The HPSI pump data is summarized in Table 6.3-1, and Figures 6.3-4a and 4b.

6.3.2.2.4 Refueling Water Tank

The refueling water tank (RWT) is an atmospheric tank containing water borated to between 1720 ppm and 2100 ppm. The RWT is equipped with a high water level alarm which, when actuated, alarms and annunciates in the control room thus identifying the condition. The over-flow alarm actuates at a level six inches below the RWT overflow nozzle which is 7350 gallons less than the spillover capacity. Assuming that the pump with the largest capacity is being used to fill the tank (primary water pumps @ 300 gpm) the operator has at least 24 minutes to shut the pump off before the RWT overflows. Operation of the RWT is not needed during normal operation, and use of it is under strict administrative control.

B/2

The possibility of RWT overflow from each of the fill lines was evaluated. The limiting RWT fill source is the 3,100 gpm from the LPSI pumps which allows the operator 2.4 minutes to respond before the tank overflow occurs. All other tank fill sources provide the operator a minimum of 20 minutes before any action is required. A tabulation of fill sources is presented in Table 6.3-21.

To limit the possibility of RWT overflow an air operated, fail-closed automatic block valve (LCV-07-12) on the LPSI fill line closes upon receipt of a high RWT level signal. In addition to the high RWT level alarm at 37.5 feet, annunciation of high-high RWT level at 37.75 feet, is provided. The high-high level annunciation receives a signal from a source different from the present high-level alarm signal for additional reliability and is alarmed in the control room. This increases the operation response time margin and minimizes the potential for RWT overflow. See Figure 6.2-41 for RWT fill sources.

Should the RWT overflow, the discharge would flow to a local catch basin east of the RWT and then enter the plant storm drainage system.

The RWT is vented to the atmosphere through a mushroom vent on the top of the RWT.

The RWT is sized to contain sufficient water to fill the refueling water canal, transfer tube and the refueling cavity to a depth of 24 feet above the reactor vessel flange for refueling operation. This required volume is 500,000 gallons. Actual tank volume is 554,000 gallons.

The RWT also provides the reservoir of borated water for the injection mode operation of the Safety Injection System. The RWT is a seismic Category I, ASME III Class 2 structure designed to store borated water for use by the Containment Spray (CS), High Pressure Safety Injection (HPSI), and Low Pressure Safety Injection (LPSI) pumps. The Technical Specifications level accounts for the following volumes of water:

a) Injection Flow: A quantity of 313,600 gallons is maintained to provide a minimum of 20 minutes of injection flow for the CS, LPSI, and HPSI pumps. This quantity is determined using conservative system runout flows for all pumps.

b) Unusable Volume: All stored water below a line six inches above the upper edge of the suction is considered unusable. This quantity of 60,000 gallons is considered in the Technical Specifications determination.

C) Transfer Allowance: An additional volume of 23,600 gallons is stored to account for the time (90 seconds) required to transfer to the recirculation mode. This quantity conservatively assumed that both LPSI pumps fail to stop on receipt of the Recirculation Actuation Signal (RAS) and continue to draw during the transfer process. Thus, no single failure can cause the tank to be drawn dry.

TABLE 6.3-21
RWT FILL SOURCES

LINES TO RWT	SOURCE	RATED FLOW (gpm)	TIME ELAPSED BETWEEN HIGH ALARM AND OVERFLOW (MINUTES)
6"-CS-500	LPSI Pumps	3,100	2.4
6"-SI-154	HPSI Recirc.	30	250
	LPSI Recirc.	100	75
	CS Recirc.	150	50
3"-CS-62	Reactor Drain Pumps	50	150
3"-WM-A56	Hold Up Drain & Recirculation Pumps	80	94
3"-PMW-16	Primary Water Pumps	325	23
3"FS-556	Fuel Pool Purification Pump	150	50
I-3-CH-938	Boric Acid Makeup Pumps	143	50

Refer to Dwg.
2998-G-078 SH 140

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

FUEL POOL COOLING
AND CLEANUP SYSTEM

FIGURE 9.1-6

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: DRAWING NO.: 2998-G-078, "FLOW DIAGRAM FUEL POOL SYSTEM", SHEET 140

WITHIN THIS PACKAGE... OR, BY SEARCHING USING THE DOCUMENT/REPORT 2998-G-078, SHEET 140

D-01

ST. LUCIE, UNIT 2

of resin with the effluent. The internal wetted surface is stainless steel.

d) Fuel Pool Skimmer

The fuel pool skimmer removes floating pollutants from the surface of the fuel pool during purification operations. This portable component uses a small fraction of purification suction flow for its operation. It is a floating weir type skimmer.

e) Fuel Pool Purification Pump Suction Strainer

The fuel pool purification pump suction strainer prevents any relatively large particles from entering the fuel pool purification pump. The internal wetted surface is stainless steel,

f) Fuel Pool Ion Exchanger Strainer

The "Y" strainer removes resin fines from the purification flow in the event of fuel pool ion exchanger lower retention element failure. Blowdown is directed to the spent resin tank in the Waste Management System. The internal wetted surface is stainless steel. O.S.

g) Fuel Pool Cooling Pumps

There are two fuel pool pumps installed for parallel operation. Under normal operating conditions, only one pump is required for operation. The pumps are centrifugal type and provided with mechanical seals. These pumps are ASME III Class 3 and the motors are Class 1E safety related components.

The seals are provided with leakoff vent and drain connections.

h) Fuel Pool Purification Pump

The centrifugal type fuel pool purification pump is provided with mechanical seals to minimize shaft leakage. The seals are provided with leakoff vent and drain connections. It is a non-safety pump which is physically independent and electrically separated from the Class 1E components.

i) Piping and Valves

All the piping in the Fuel Pool System is stainless steel with mostly welded connections throughout. All the valves in the Fuel Pool System are stainless steel, at least 150 lb. ANSI pressure rating.

9.1.3.2.4 Instrumentation Requirements

A tabulation of instrument channels is included in Table 9.1-7

e) Fuel Pool Purification Filter and Fuel Pool Ion Exchanger Differential Pressure

Differential pressure of the fuel pool purification filter and the fuel pool ion exchanger are indicated locally.

Periodic readings of these instruments indicate any progressive loading of the units.

O, S

9.1.3.2.4.3 Level Instruments

a) Fuel Pool Water Level

The fuel pool water level is monitored by two redundant level switches. These switches actuate a hi/low level alarm in the control room to warn the operator of system malfunction. Two separate level instrument channels are used due to the importance of maintaining fuel pool water level.

9.1.3.3 Safety Evaluation

The Fuel Pool System has been designed to provide continuous cooling for partial core offload and full core offload conditions (Reference 10). These discharge conditions are defined in Table 9.1-8.

With a batch discharge of 96 assemblies, which is assumed to have been depleted to an average 55 GWD/MTU, placed in the spent fuel pool five days after reactor shutdown and 1396 previously discharged assemblies, the heat load is 19.76 x 10^6 Btu/hr. Under these conditions, with one fuel pool pump operating and the fuel pool heat exchanger in service, the spent fuel pool temperature does not exceed 140°F.

For the generic analysis of full core offloads, it is assumed that one full core is placed in the fuel pool seven days after reactor shutdown. Another 11 batches are stored in the spent fuel pool (a total of 1113 assemblies including the full core offload) and have undergone 48 months of full power irradiation and have decayed for 18 months, 36 months, etc. following discharge from the core. The resultant heat load from one full core and eleven 18 month cycle refueling batches is 31.7 E6 BTU/hr. In this generic analysis it is assumed that both fuel pool cooling pumps are in service to limit the maximum fuel pool water temperature to less than 150° F. A maximum fuel pool temperature of 150° F has been found acceptable in previous Safety Evaluation Reports, including Reference 14. Reference 14 also requires that for subsequent full core offload evolutions, St. Lucie perform an outage-specific calculation to assure the bulk spent fuel pool water temperature remains at or below 150° F with one heat exchanger and one fuel pool cooling pump in operation. These cycle-specific heat load calculations will consider the actual number of assemblies stored in the fuel pool, even if more than 1113 assemblies are present.

O, S

TABLE 9.1-7

FUEL POOL SYSTEM INSTRUMENTATION

Instrument Identification Number	System Parameter & Location	Indication Local	Indication Control Room	Alarm Local	Alarm Control Room	Instrument[(1)] Range	Normal Operating Range	Instrument[(1)] Accuracy	Instrument Qualification Status
TI-4420	Fuel Pool Temperature	*			Hi		120-150°F		Class 1E
TI-4421	Fuel Pool Temperature	*			Hi		120-150°F		Class 1E
TI-4416	Fuel Pool Heat Exchanger Outlet Temp	*					120-150°F		Non 1E
TI-4405	Fuel Pool Heat Exchanger Outlet Temp.	*					100-130°F		Non 1E
TI-4425	Fuel Pool Ion Exchanger Inlet Temperature	*					100-140°F		Non 1E
LS-4420	Fuel Pool Water Level				Hi/Lo	-	-		Class 1E
LS-4421	Fuel Pool Water Level				Hi/Lo	-	-		Class 1E
PI-4402	Fuel Pool Pump 2B Discharge Pressure	*					40-50 psig		Non 1E
PI-4401	Fuel Pool Pump 2A Discharge Pressure	*					40-50 psig		Non 1E
PI-4411	Fuel Pool Purification Pump Suction Pressure	*					5-10 psig		Non 1E
PS-4403	Fuel Pool Pump Discharge Header Pressure				Lo	-	40-50 psig	Non 1E	
PI-4412	Fuel Pool Purification Fuel Pool Pump Discharge	*					75-90 psig		Non 1E
PDI-4415	Fuel Pool Purification Filter Differential Pressure	*					5-30 psid		Non 1E
PDI-4416	Fuel Pool Ion Exchanger Differential Pressure	*					7-10 psid		Non 1E

(1) Instrument ranges are selected in accordance with standard engineering practices. Instrument accuracies are selected such that existing instrument loop performance and safety analysis assumptions remain valid. Where applicable, instrument accuracies are also evaluated for their impact on setpoints in accordance with the FPL Setpoint Methodology.

Refer to Dwg.
2998-G-088, Sh. 1 & 2

FLORIDA POWER & LIGHT COMPANY **ST. LUCIE PLANT UNIT 2**
FLOW DIAGRAM CONTAINMENT SPRAY AND REFUELING WATER SYSTEMS **FIGURE 6.2-41**

AMENDMENT NO. 10, (7/96)

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: DRAWING NO.: 2998-G-088, "FLOW DIAGRAM CONTAINMENT SPRAY AND REFUELING WATER SYSTEMS", SHEET 1

WITHIN THIS PACKAGE... OR, BY SEARCHING USING THE DOCUMENT/REPORT 2998-G-088, SHEET 1

D-02

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:
DRAWING NO.: 2998-G-088,
"FLOW DIAGRAM CONTAINMENT SPRAY AND REFUELING WATER SYSTEMS",
SHEET 2

WITHIN THIS PACKAGE... OR, BY SEARCHING USING THE DOCUMENT/REPORT 2998-G-088, SHEET 2

D-03