Overview
Ameren Missouri Callaway Plant

UHS Cooling Tower and Retention Pond Technical Specification Modifications

August 2012

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License Amendment Request 12-0015: UHS Retention Pond

LICENSEE EVENT REPORT, 2010-004-00 (ULNRC-05701), *Unanalyzed Single Failure Component for Ultimate Heat Sink/Essential Service Water*

Follow up response:

The single failure of the UHS Cooling Tower Inlet Bypass Valve was not considered. (Identified by NRC Resident Inspector)

Single Failure analysis was not revised after Unit 2 was canceled.

Failure of the bypass valve would result in hot water flowing directly into the UHS Pond bypassing the UHS Cooling Tower Fans.

UHS Pond temperatures under worst case conditions could exceed the maximum analyzed temperature during a Design Basis Accident (LBLOCA) with a single active failure of the UHS Cooling Tower bypass valve.

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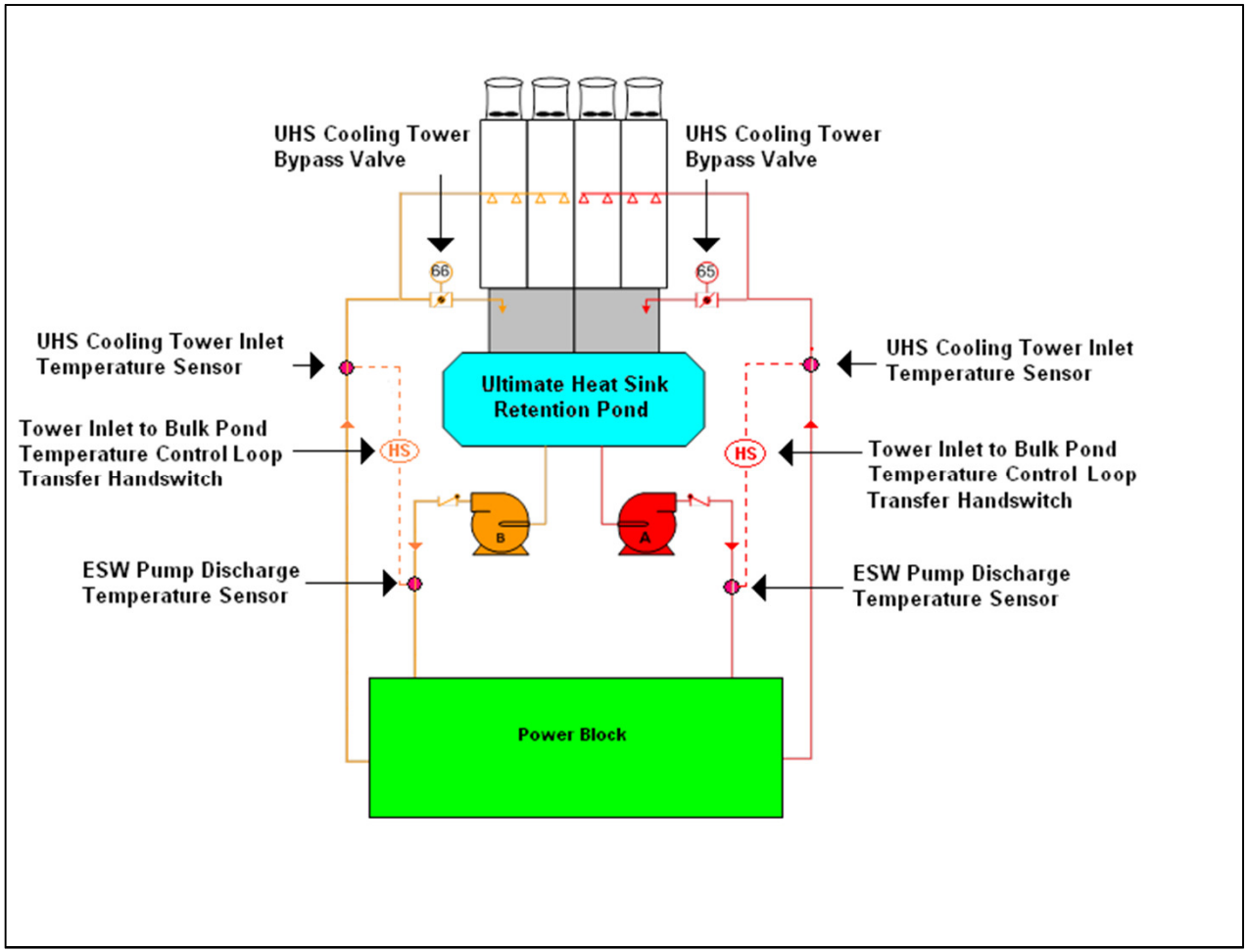
ESW/UHS System Simplified Diagram



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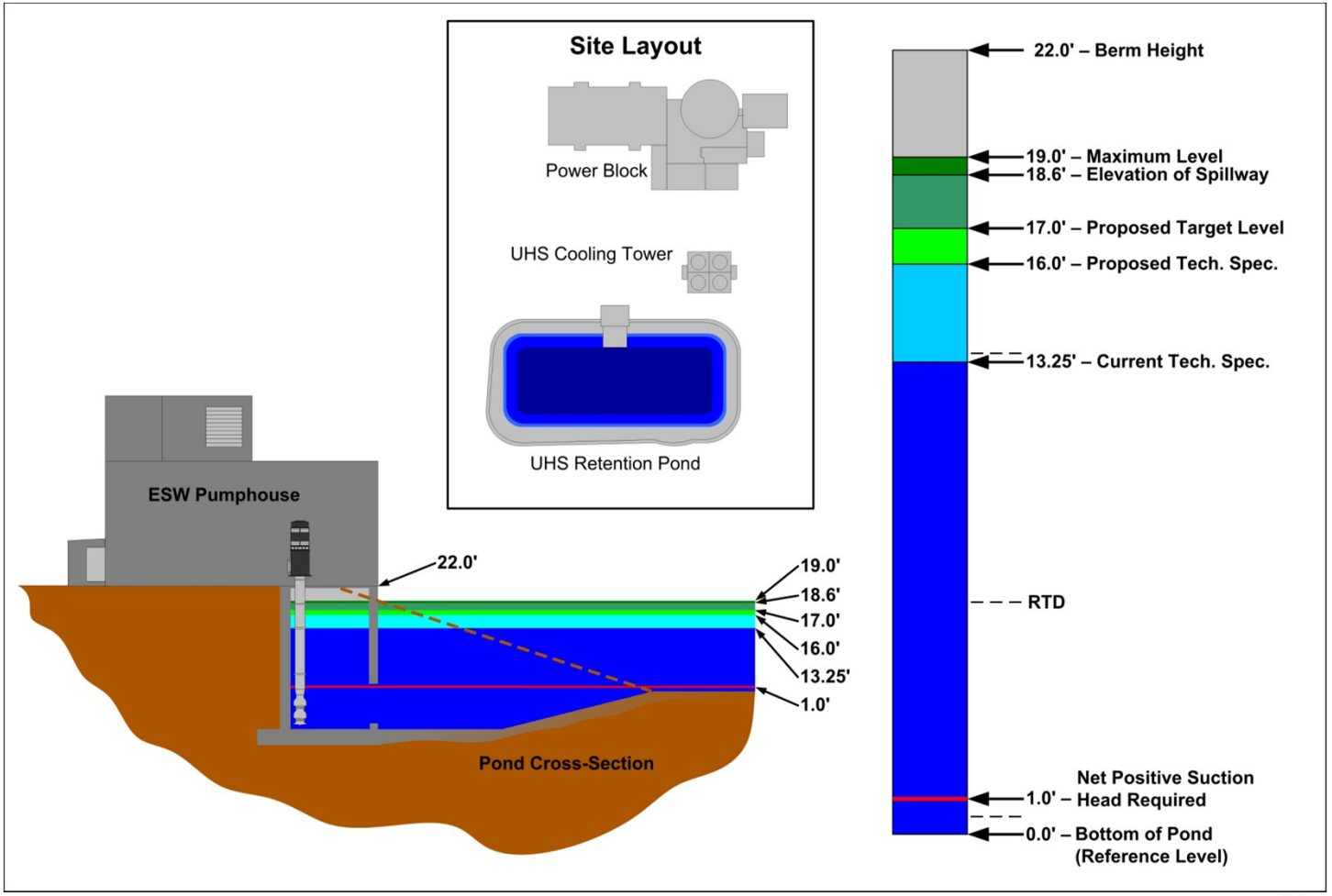

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LAR will discuss the following:

- Revise SR 3.7.9.1, the maximum initial UHS Retention Pond average temperature will be reduced from 90 F to 89 F.
- Revise SR 3.7.9.2, the UHS Retention Pond Level will be increased from a minimum initial level of 13' - 4" to 16' of depth above pond bottom.
- Addition of new SR 3.7.9.4 to verify fan auto-start on an actual or simulated actuation signal.
- GOTHIC Thermal Hydraulic Model of ESW/UHS system
- New operator actions used in the Emergency Operating Procedures to operate the UHS system.
- Remote manual bypass valve position control from the Main Control Room

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Background: The UHS Cooling Tower rejected less heat from the ESW system to the atmosphere with one train of ESW operation during the worst case conditions than intended by the original design specification.

Union Electric determined to run both trains of ESW during a Design Basis Accident and perform analysis of the Cooling Tower as needed.

The analysis of record was compartmentalized. Static output data from one calculation becomes the input for the next calculation.

The FSAR credits operator actions to maintain UHS pond temperature within allowable limits during hot weather operation.

Callaway Plant needed an integrated approach when calculating the ESW heat loads to determine the dynamic thermal interactions in Containment and the UHS Retention Pond.

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Thermal Performance Analysis of UHS Cooling Tower and Retention Pond:

Westinghouse created a GOTHIC 7.2(b) model of the entire heat path from Containment to the UHS Pond.

The model includes Containment, RHR, CCW, EDG, SFP, and the Auxiliary Building Room Cooler heat loads involved in a LBLOCA event.

The UHS Cooling Tower and Pond model includes worst-case weather and temperature conditions.

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Issues Identified through new Thermal Performance Analysis:	Initial Technical Specification pond temperature acceptance criteria challenged Design Bases Accident pond temperature analyzed limit (92.3 F) margin.
	Initial minimum pond level (TS) challenged ESW inventory for the 30-day mission time.
	Control of the Cooling Tower operation was appropriately controlled in the short term but could be improved for long-term operation.

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Two worst case scenarios were analyzed in the new

Thermal Performance Analysis - Over a 30-day Mission Time:

Minimum Heat Transfer: A hot Summer day with very *high* humidity conditions. This challenges UHS Pond temperature by minimizing the evaporative cooling rate but preserves pond inventory.

Maximum Evaporation: A hot Summer day with very *low* humidity conditions. This maximizes forced convection cooling in the UHS Cooling Tower keeping UHS Pond temperatures low but challenges UHS Pond inventory through evaporative losses.

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New Thermal Performance Analysis Impact on UHS Cooling Tower Control Loop:	Controlling the UHS Cooling Tower off of the temperature sensor that is upstream of the tower, cycles fan speed too frequently and is not suitable for long-term inventory management.
	Controlling the UHS Cooling Tower off of bulk pond temperature is unacceptable for limiting the initial heat load transferred into the pond at the onset of the accident.

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Required changes as a result of the New Thermal Performance Analysis:	The maximum initial UHS Retention Pond average temperature will be reduced from 90 F to 89 F.
	UHS Retention Pond Level will be increased from a minimum initial level of 13' - 4" to 16' of depth above pond bottom.
	A manual hand switch in the Main Control Room (one per train) will swap automatic UHS system controls from the Cooling Tower inlet temperatures in the short term to bulk pond temperature for long term cooling.
	Operator actions are used in the Emergency Operating Procedures to properly operate the UHS system.

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Additional adjustments to Callaway Plant implemented under 10CFR50.59 for proper UHS Cooling Tower and Retention Pond operation:	UHS Cooling Tower Fan Speed and bypass valve set-points were lowered, ESW supply temperature control loops were added, and additional bypass valve manual operation switches (providing a false high temperature input that closes the bypass valves) were installed.
	UHS Cooling Tower fan speed indication, additional valve position indications (from the new switches above), and fan trouble alarms were added to the Main Control Room.
	Normal UHS Retention Pond operating level limits were modified.
	Revising the Single Failure response described in the FSAR.
	Clarifying the analyzed maximum UHS Retention Pond temperature in the FSAR during a LBLOCA.

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THERMAL PERFORMANCE ANALYZED RESULTS :

	Analysis Scenarios		Maximum UHS Retention Pond Temperature (°F)	Time to Pond Peak Temperature	Final UHS Retention Pond Level after 30 days (ft)
Case 1	LBLOCA with Single Active Cooling Tower Bypass Valve Failure	Maximum Evaporation	91.74	2.57 hr	3.05
Case 2		Minimum Heat Transfer	**92.00**	5.83 hr	8.50
Case 3	LBLOCA without Single Active Tower Bypass Valve Failure	Maximum Evaporation	89.23	6.8 min	**2.81**
Case 4		Minimum Heat Transfer	89.23	6.8 min	6.80

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UHS Cooling Tower fan setpoints:

Previous Fan Setpoints:
High Fan Speed 114 F
Low Fan Speed 104 F
Valve close 91 F

Current Tower Inlet Control Loop Setpoints:
High Fan Speed 105 F
Low Fan Speed 95 F
Valve close 84 F

Current Bulk Pond Control Loop Setpoints:
High Fan Speed 89.5 F
Low Fan Speed 84.5 F
Valve close 79 F

UHS Cooling Tower fan speed set-points were revised.

Operation of the UHS Cooling Tower is automated.

The Cooling Tower controls are swapped over to bulk pond temperature to protect the Cooling Tower fans and retention pond inventory during the 30 day mission time.

A balanced approach has been achieved where the UHS Cooling Tower can perform its safety function.

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Operator Timed Actions:	**With the Single Failure** of the UHS Cooling Tower Bypass Valve operators will verify that the valve is closed or secure the impacted train of ESW within **70 minutes** from the start of the LBLOCA event.
Original Credited Operator Action: Operators would secure one train of ESW at 8 hours	Without a cooling tower single failure operators will secure one train of ESW within **7 days**.
	At **4 hours** post LBLOCA Operators will switch UHS system automatic controls from Cooling Tower inlet temperature (ESW return) to bulk Retention Pond temperature (ESW supply).
	Operators will address a single electrical failure of a Tower inlet or Pump discharge temperature sensor loop within **24 hours.**

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Summary of Changes

The maximum initial UHS Retention Pond average temperature (TS Limit) will be reduced from 90 F to 89 F.

Minimum initial UHS Retention Pond Level (TS Limit) will be increased from 13' - 4" to 16' of depth above pond bottom.

New SR 3.7.9.4 to be added to TS for verifying fan auto-start on an actual or simulated actuation signal.

GOTHIC Thermal Hydraulic Model of ESW/UHS system to be described in the License Amendment.

A manual hand switch in the Main Control Room (one per train) will swap automatic UHS system controls from the Cooling Tower inlet temperatures in the short term to bulk pond temperature for long term cooling. (Already implemented under 10CFR50.59.)

Operator actions are used in the Emergency Operating Procedures to properly operate the UHS system.

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Questions?

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