North Anna ESP Application

Meeting With NRC Staff
March 10, 2006

Attachment 3

Agenda

- Objective
- Description of Cooling System
- Detailed Discussion of Staff RAIs
- Identification of Open Actions

Dominion

Overview

- How did we get here?
- Cooling System Design
- Water Saving Features
- Model Comparisons

Dominion

Stakeholder Issues with Once-Through Cooling

- Water Temperatures
  - Residents concerned with increase in WHTF temperature
  - Potential impact on striped bass
- Water Consumption
  - Lake level below 248 ft MSL
  - Reduced outflow from dam

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What is needed?

- Reduce thermal impact to the WHTF and Reservoir
- Reduce water consumption
- Problem: Methods for reducing temperature involve evaporating water for heat removal.

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What is needed?

- Solution: Incorporate water conservation into closed cycle cooling system.
  - Removes thermal impact to WHTF / Reservoir
  - Portion of dry cooling to reduce evaporation
  - Water-saving wet towers
  - Lower condenser flow increases dry tower efficiency.

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Cooling Water System Design

- Substantially addresses concerns expressed by agencies and the public
  - Unit 3 will use a closed cycle cooling system.
  - No additional cooling water flow to WHTF and no additional thermal impact to Lake Anna.
  - Water consumption for Unit 3 substantially reduced.
  - Significant reduction in Unit 3 impingement and entrainment.

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Cooling Water System Design

- Closed Cycle cooling system design
  - Unit 3 condenser water cooled initially in Dry Towers
    (forced air = no water loss).
  - Water then passed through Wet Towers
    (water spray = some evaporation with condensation return).

- Two operating modes
  - Energy Conservation (EC) – Dry cooling will be reduced with reliance on wet towers for heat removal.
  - Maximum Water Conservation (MWC) – 1/3 heat removal by Dry, 2/3 heat removal by Wet.

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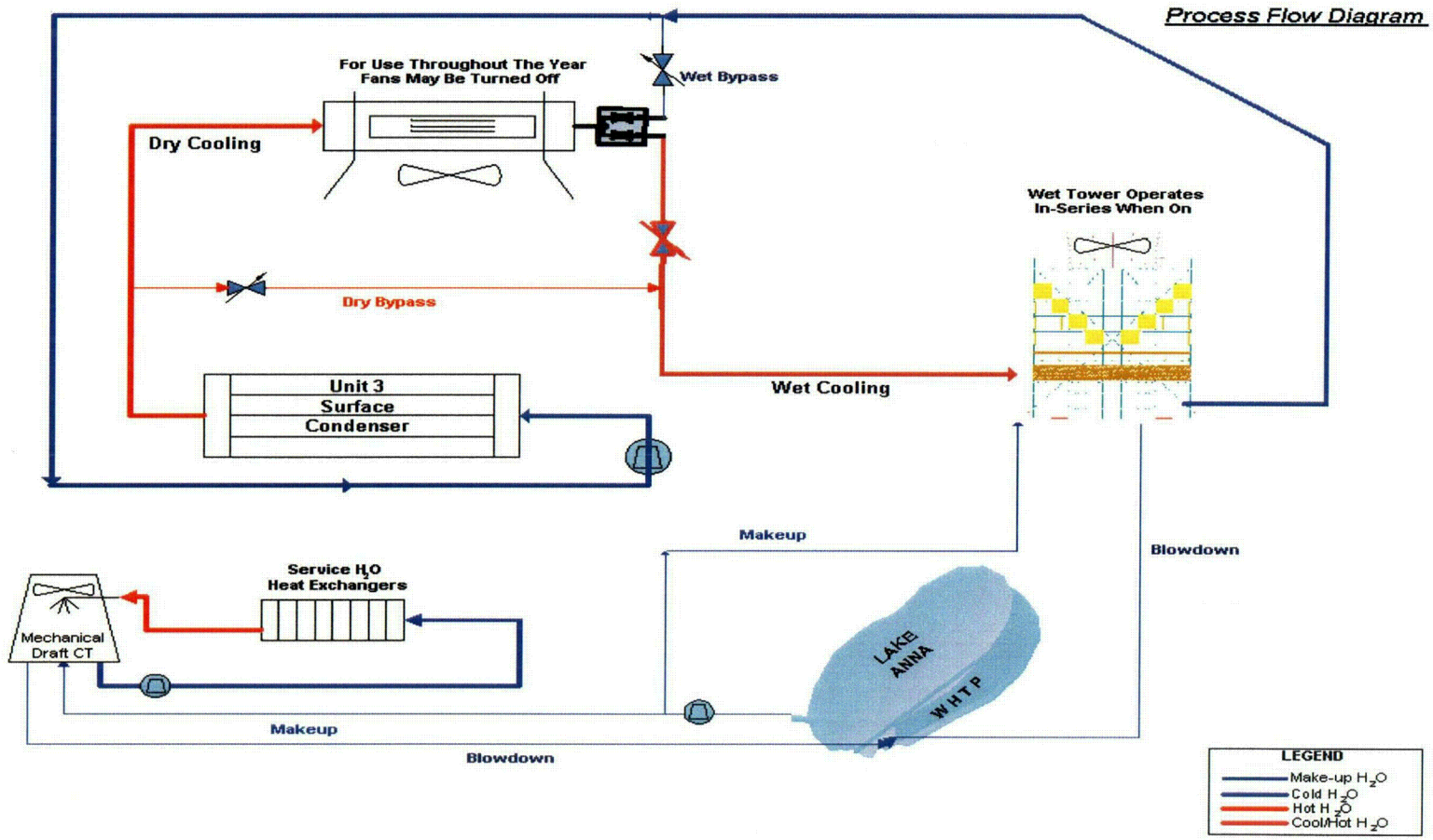
Flow Path & Cycles

NORTH ANNA EARLY SITE PERMIT - HEAT SINK EVALUATION CLOSED LOOP SYSTEM DRY/WET (IN-SERIES) SYSTEM



C01

Cooling Water System Design

- Operating Assumptions for Analysis
  - When Lake level is at or above 250 ft. MSL, the EC mode will be used.
  - If Lake level is below 250 ft. MSL and if the level is not restored within 7 days, the MWC mode will be used.

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Cooling Water System Design

- Design Criteria/Assumptions
  - Heat Duty: 2900 MWth (1E10 Btu/hr)
  - One-Third Dry Cooling Capacity / 100% Wet Cooling Capacity
  - Circulating Water Flowrate = 670,000 gpm
  - Return Temperature = 100 ºF
  - Service Water evaporation is included in water budget analysis.

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Cooling Water System Design

- Wet Towers
  - 52 cells – 66 ft X 66 ft
  - Tower height of approximately 80 feet, maximizes land use
  - Will consider taller towers, height will be included in the PPE
- Dry Towers
  - 100 cells – 42 ft X 44 ft
  - Tower height bounded by wet towers

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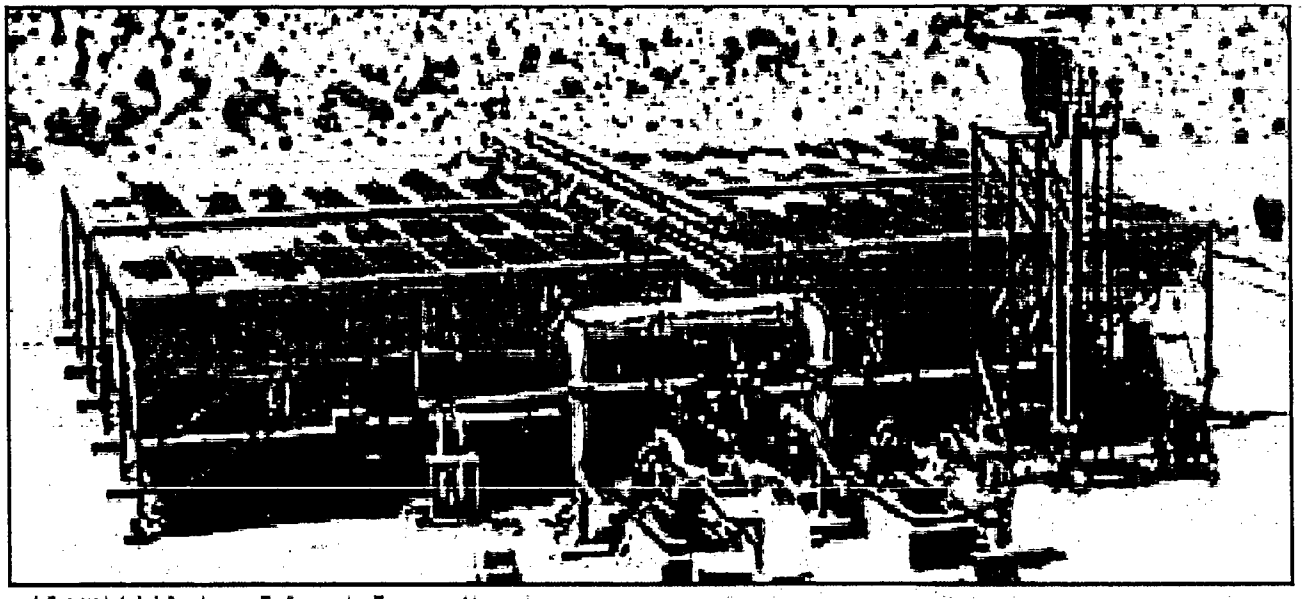
Dry Cooling Towers



465 MW CCCP plant, El Dorado Energy, Nevada

- SPX Cooling Technologies

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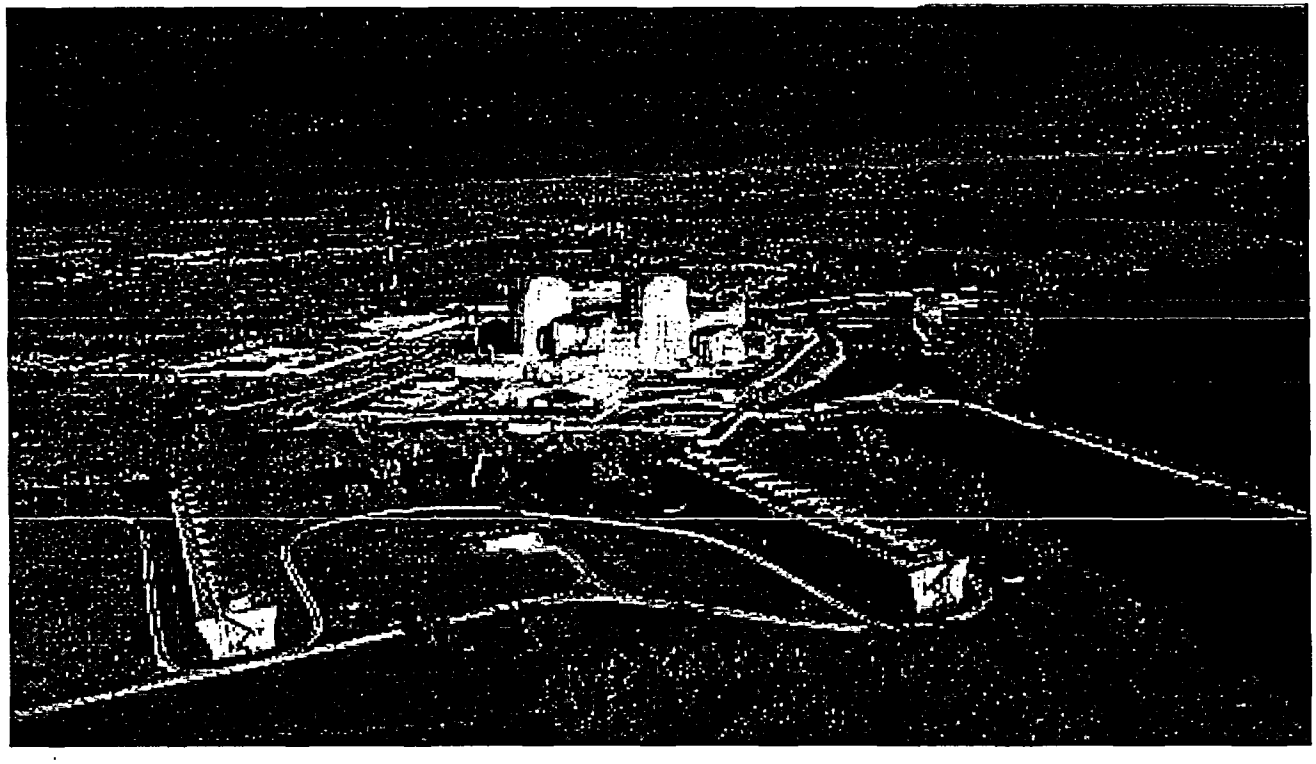
Wet Cooling Towers



Prairie Island Nuclear Power Plant

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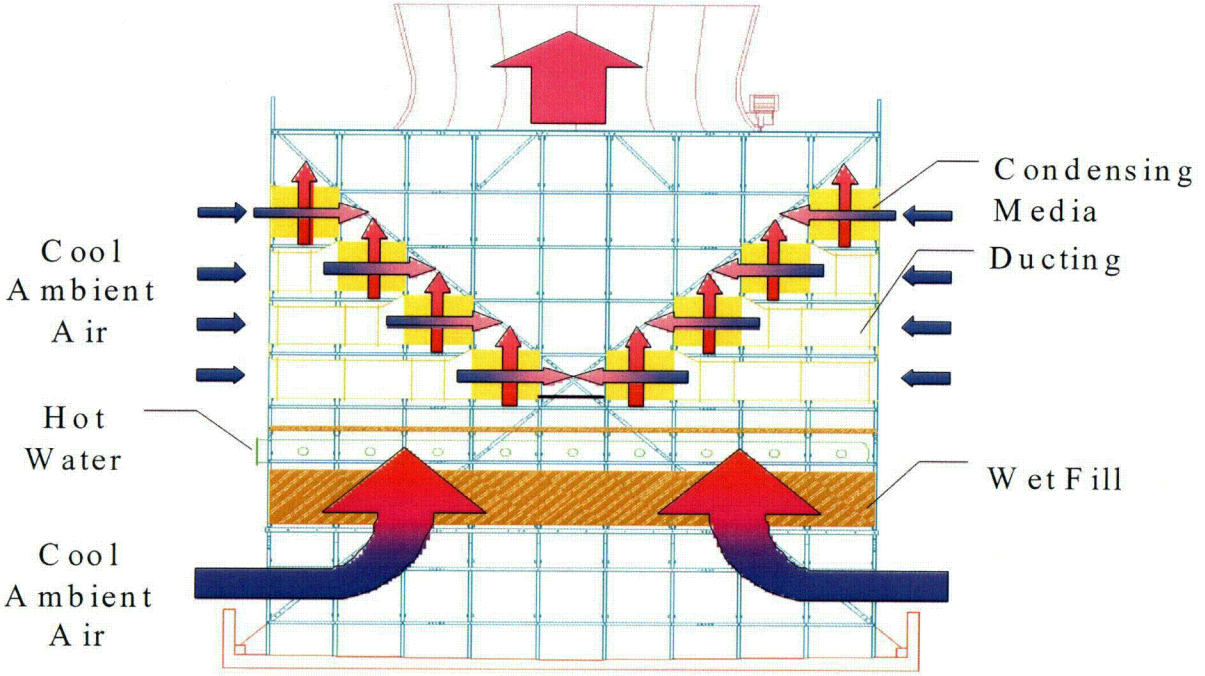
Wet Cooling Towers

Marley Cooling Technologies

Figure 1. Air to Air Cooling Tower



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C02

Cooling Model Comparisons

- % Time Water Level is Below 248 ft, msl
  - Existing Open Cycle Once-Through 5.2
  - Proposed Open Cycle Once Through (ESP Rev. 5) 11.6
  - Closed Wet Towers Only* 11.2
  - Closed Cycle Wet/Dry (EC & MWC) 7.3
  - Closed Cycle Wet/Dry (MWC Only) 7.1
- Lowest Lake Level During 2002 Drought (change), ft
  - Existing Open Cycle Once-Through 245.1 (0)
  - Proposed Open Cycle Once Through (ESP Rev. 5) 242.6 (2.5)
  - Closed Wet Towers Only* 242.6 (2.5)
  - Closed Cycle Wet/Dry (EC & MWC) 244.2 (0.9)
  - Closed Cycle Wet/Dry (MWC Only) 244.2 (0.9)

*unverified

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Cooling Model Comparisons

Based on Historical Ambient Conditions…

- Average Water Consumption, cfs (approx. gpm)
  - Proposed Open Cycle Once Through (ESP Rev. 5) — 28 (12,600)
  - Closed Wet Towers Only* — 26.4 (11,850)
  - Closed Cycle Wet/Dry (EC & MWC) — 18.5 (8,300)
  - Closed Cycle Wet/Dry (MWC Only) — 7.1 (3,200)

Assumes 96% capacity factor.

*unverified

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Summary

- Closed Cooling Design addresses stakeholder issues.
- Wet and Dry Cooling Tower System removes thermal impact from the lake and provides for significant water savings.

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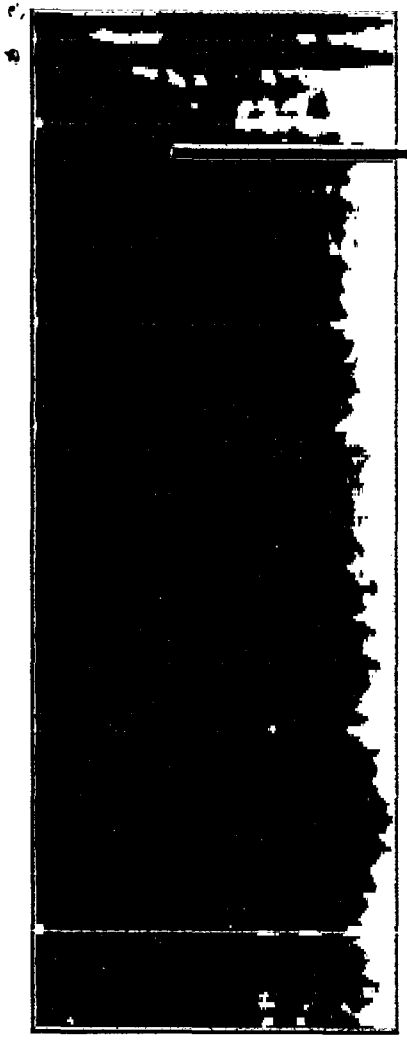

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