Jud W. White, Ph.D.

Environmental Policy Manager
Dominion

Experience: Dr. White has been employed by Dominion since 1975 and he has served in various positions in the environmental department. These positions have included activity ranging from environmental field sampling, to regulatory/permit compliance, to public affairs, to legislative support, and to policy development. Currently, Jud oversees water policy issues at all Dominion facilities in 8 states. He has broad knowledge of state and federal environmental laws and regulations and has participated on many state/federal advisory groups in helping develop environmental policy or address an environmental issue. He is also currently an affiliate professor at VCU and is teaching a graduate course titled Business and the Environment.

Education - B.S. and M.S. in Biology - University of Richmond
Ph.D. degree (2000) in Public Policy and Administration – Virginia Commonwealth University (Dissertation Title: Accountability Issues For A Point/Nonpoint Source Effluent Trading Program in Virginia)

John D. Waddill, P.E.

Lead Civil/Mechanical Engineer for the North Anna Combined Operating License Project.
Dominion

Experience: Mr. Waddill has been involved in the design and analysis of nuclear power station systems for 29 years. His areas of concentration have been cooling water systems and thermal and hydraulic modeling. He led a project team in the development and demonstration of an on-line heat transfer monitoring system for an operating nuclear station. In 2005, Mr. Waddill joined Dominion's North Anna Early Site Permit and Combined Operating License Project as Lead Civil/Mechanical Engineer and has been the technical lead for the development of the hybrid cooling system concept for the proposed Unit 3.

Education: Mr. Waddill holds a Bachelor of Science in Mechanical Engineering from Virginia Tech and a Masters of Business Administration from Queens University in Charlotte. He is a Registered Professional Engineer in North Carolina.

~~Thermal Issues and a Hybrid Cooling Technology in Siting North Anna Unit 3~~

By
Jud White and John Waddill
Dominion Resources, Inc.

Second Thermal Ecology and Regulation Workshop
October 3, 2007

Dominion
It all starts here.

PP640.1

Helping Meet Our Future Energy Needs With Nuclear Power

Some Questions That We Will Address

- Why nuclear?
- Why at North Anna?
- What's the regulatory process?
- What are the environmental issues?
- ~~What is a hybrid cooling system?~~
- Are there any lessons learned?

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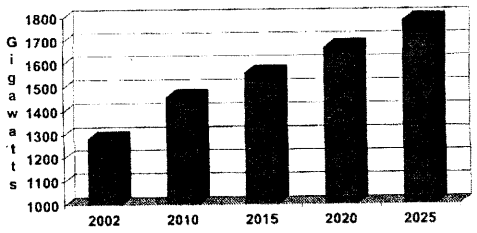
PP640.2

Projected U.S. Electricity Consumption



Source: EIA Annual Energy Outlook 2004 Table A2

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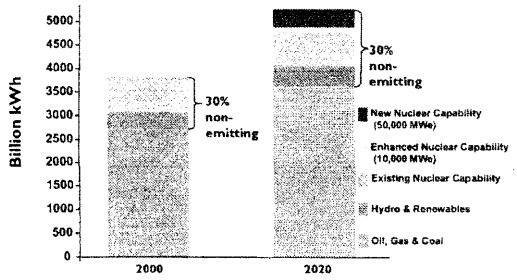
50,000 MWe of New Nuclear Needed to Maintain Existing Energy Supply Diversity



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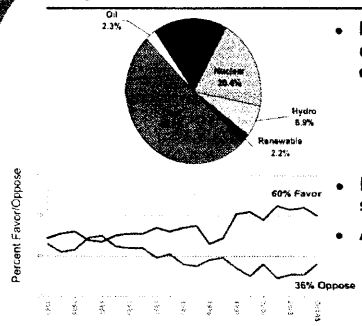
Why is Dominion Interested in New Nuclear?



- Maintain the diversity of our electricity supply
- Increased public support
- Avoided emissions

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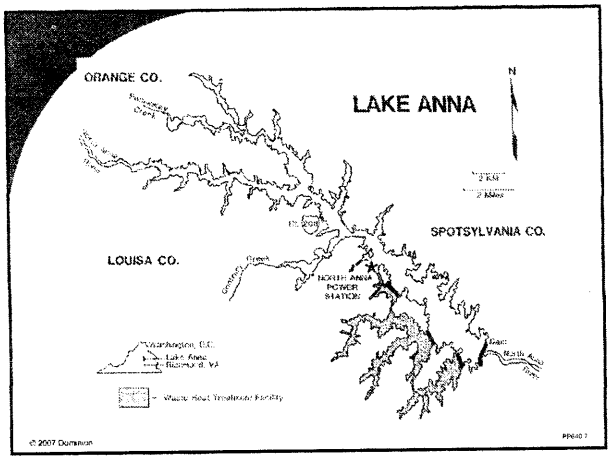
Why the North Anna Site?

- Space
- Environmentally acceptable
- No superior alternative
- Originally planned for 4 units



Overview of Nuclear Project

- NRC licensing process: Early Site Permit (ESP) for site suitability; separate Construction and Operating License (COL)
- ESP application submitted to NRC in 2003 for 2 units at 1520 MWe each
- In 2003-2006: NEPA process commenced and required state concurrence with coastal zone program of state (received in 2006)
- ~~Unit 3 cooling system changed in 2005 from open to closed cycle due to agency and public concerns~~
- FEIS issued in 2006; COL application in late 2007; construction in 2010

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State Requirements - CZMA

- State concurrence with our Federal Consistency Certification under the Coastal Zone Management Act (CZMA) was needed prior to issuance of ESP
- CZMA was only state authorization needed for ESP; additional permitting underway in COL process
- CZMA Question asked - Is the project consistent with enforceable policies of the Va. Coastal Resources Management Program?
- Multiple state agencies review as well as public
- State may deny, approve, or approve the certification with conditions

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Lake Level Hydrograph

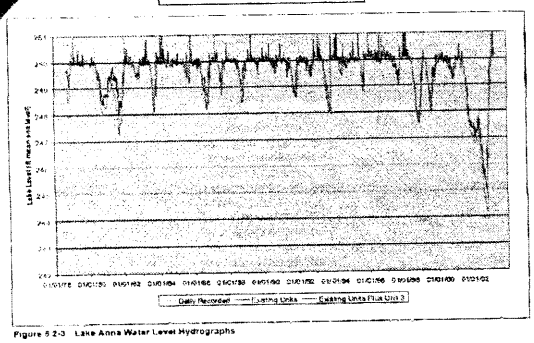

Figure 5.2-3 Lake Anna Water Level Hydrographs

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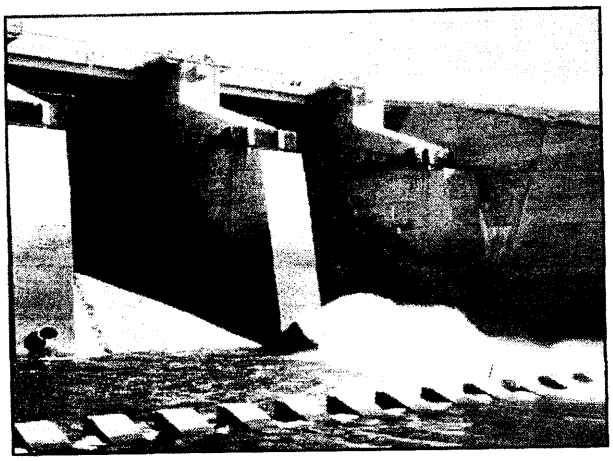

What is an IFIM Study?

- A widely used tool for assessing the effects of flow regulation on river habitats for fish; can also include recreational uses.
- Traditional instream flow regulatory determinations often geared to maximize habitat for single life stage of a high-profile fish species at a few isolated spots in a river.
- Current IFIM process allows for more comprehensive regulatory determinations with consideration for multiple target species.
- Expect completion in early 2008

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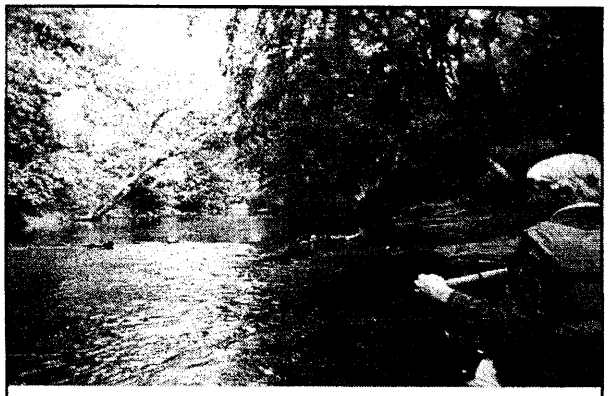

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~~Hybrid Cooling Technology~~
~~North Anna Unit 3~~

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~~*Wet/Dry Cooling Concept/How does it work?*~~

- ~~Closed cycle cooling system design~~
  - ~~**Dry** and water conserving **Wet** Cooling Towers~~
  - ~~Significantly reduces water consumption.~~
  - ~~Unit 3's condenser water **cooled initially in Dry Towers** (**forced air = no water loss**). Water **then passed through Towers** (**water spray = some evaporation with condensa return**).~~
- ~~Two conceptual operating modes~~
  - **Energy Conservation (EC)** ~~- Dry cooling will be reduced w reliance mostly on wet towers for heat removal.~~
  - ~~**Maximum Water Conservation (MWC)** - Minimum **1/3** hea removal by **Dry**, balance of heat removal by **Wet**.~~

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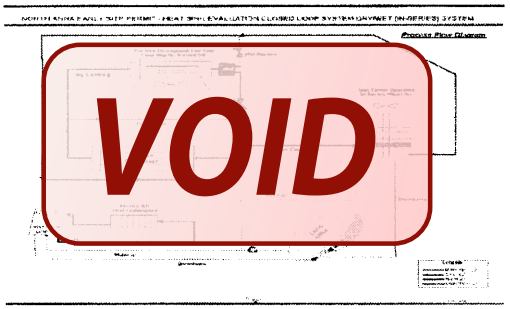
~~Conceptual Flow Path & Cycles~~



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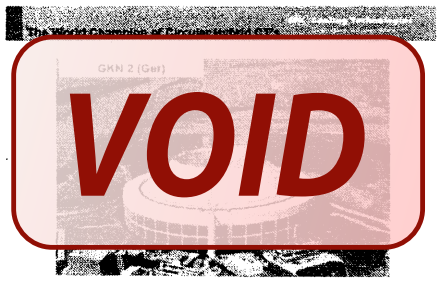
~~Hybrid Cooling Tower Example~~



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Looking to the Future

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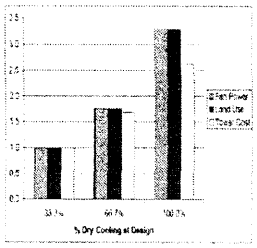
How much dry cooling?



Trade Offs

Energy to operate the system

Land Use

Cost

Cycle efficiency loss

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~~*Resulting Performance*~~

~~***Bad News*** **= The system performs best when normally not needed → Cool weather.***~~

~~***Good News*** **= When you *really* need it, the system can perform → Long droughts.***~~

- ~~**Projected annual average evaporation reduced by more than 30% using EC/MWC operation.**~~
- ~~**Projected annual average evaporation reduced by 70% using MWC only.**~~

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~~Resulting Performance~~

~~Model Prediction for Time Below Lake Low Level Elevation~~

Existing Units	Existing Units Plus [illegible]	Existing Units Plus Unit 3 with Hybrid Cooling
5.2%	11.[illegible]%	7.0%

VOID

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Summary and Lessons Learned

- More electricity will be needed in the future and nuclear energy will play a vital role
- New NRC licensing process allows environmental review before large investments occur
- While NRC is lead agency, the State has an important role to play in decision-making
- Ensure effective and continual communications between NRC, State, and applicant
- Sate CZMA certification process allows multiple state agencies to voice concerns about a project and it can significantly influence the outcome

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