

# Issue E – Alternative Analyses

- Overview - Jim Wilson
- Alternative Energy Sources - Paul Hendrickson
- Plant Design Alternatives – Lance Vail
- Site Selection Process and Discussion of Alternative Sites – Paul Hendrickson

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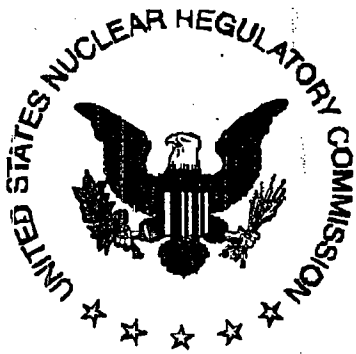
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# Energy and Site Alternatives

Paul Hendrickson

Pacific Northwest National Laboratory



# Basis for Analysis of Alternatives

- §102(2)(C) of NEPA requires preparation of an EIS for actions significantly affecting the quality of the human environment. EIS is to cover alternatives to the proposed action.
- 10 CFR Part 51 Appendix A(5) calls for presentation of alternatives in an NRC EIS in a comparative form. All reasonable alternatives are to be identified.
- 10 CFR 52.17(a)(2) calls for an ESP ER to include evaluation of alternative sites to determine whether there is an obviously superior site.



# Construction and Operation Impacts

- An ESP would not authorize construction
- Nevertheless, consistent with CEQ regulations, the FEIS considers potential construction and operation impacts because significance cannot be avoided by terming an action temporary or by breaking it down into small component parts



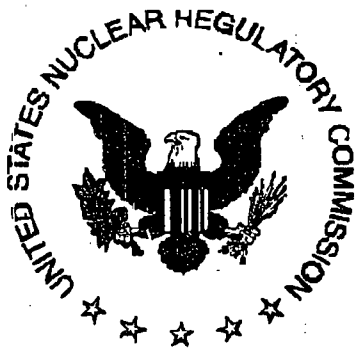
# Categories of Alternatives Considered

- Energy Alternatives
- Plant Design Alternatives
  - Heat Dissipation Systems
  - Circulating Water Systems
- Alternative Sites



# Energy Alternatives

- Commission informed applicants in a June 2003 letter that an ESP application need not include an assessment of alternative energy sources
- SERI elected to include an analysis of energy alternatives in its ER
- Analysis of energy alternatives involving and not involving new generating capacity is included in the EIS
- Staff used target value of 2000 MWe, which is consistent with the SERI ER



# Energy Alternatives Not Involving New Generation

- Purchase needed power from others
- Reactivation of retired plants
- Extend operating life of existing plants
- Conservation and demand side management programs
- Staff conclusion: options are not reasonable alternatives to a base load nuclear plant but they would be revisited at COL if new and significant information becomes available





## Energy Alternatives Involving New Generating Capacity

- Principal options considered were new coal and natural gas fired generation at the Grand Gulf site
- Other options considered were oil, wind, solar, hydro, geothermal, wood, solid waste, biomass, fuel cells, and a combination of energy options



# Staff Impact Characterizations

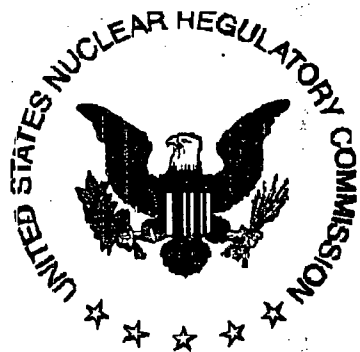
- SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource
- MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource
- LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource



## Staff Impact Characterizations of Coal-Fired Power Generation

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Impact Category	Impact
Air Quality	MODERATE
Waste Management	MODERATE
Human Health	SMALL
Land Use	MODERATE
Ecology	MODERATE to LARGE
Water Use and Quality	SMALL
Socioeconomics	LARGE Beneficial
Aesthetics	MODERATE
Historic and Cultural Resources	SMALL
Environmental Justice	LARGE Beneficial



## Staff Impact Characterizations of Natural Gas-Fired Generation

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Impact Category	Impact
Air Quality	SMALL to MODERATE
Waste Management	SMALL
Human Health	SMALL
Land Use	SMALL
Ecology	SMALL to MODERATE
Water Use and Quality	SMALL
Socioeconomics	MODERATE Beneficial
Aesthetics	SMALL
Historic and Cultural Resources	SMALL
Environmental Justice	MODERATE Beneficial



# Other Generation Alternatives

- Oil – expensive
- Wind – low capacity factor
- Solar – suitable for water heating or photovoltaic but not for baseload
- Hydropower – low resource and high impacts
- Geothermal – no suitable eastern resource
- Wood – plants too small (~40 MWe)
- Municipal Solid Waste – plants too small
- Biomass – plants too small, technology needs
- Fuel Cells – not economically or technologically competitive



## Staff Conclusion Regarding Other Generation Alternatives

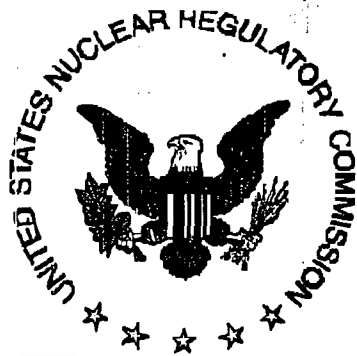
- Options are not reasonable alternatives to a base load nuclear power plant but they would be revisited at COL if new and significant information becomes available



## Staff Impact Characterizations of a Combination of Power Sources

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Impact Category	Impact
Air Quality	SMALL to MODERATE
Waste Management	SMALL
Human Health	SMALL
Land Use	SMALL to MODERATE
Ecology	SMALL to MODERATE
Water Use and Quality	SMALL
Socioeconomics	MODERATE Beneficial
Aesthetics	SMALL to MODERATE
Historic and Cultural Resources	SMALL
Environmental Justice	MODERATE Beneficial



## Staff's Characterization of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural Gas-Fired Generating Units, and a Combination of Alternatives

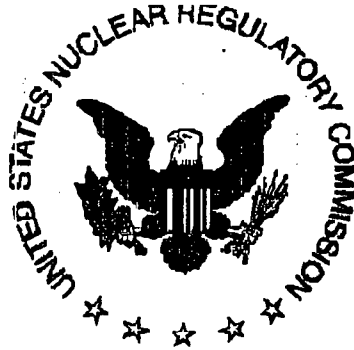
Impact Category	Nuclear	Coal	Natural Gas	Combination of Alternatives
Air Quality	SMALL	MODERATE	SMALL TO MODERATE	SMALL to MODERATE
Waste Management	SMALL	MODERATE	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	SMALL
Land Use	SMALL	MODERATE	SMALL	SMALL to MODERATE
Ecology	SMALL to MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to MODERATE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Socioeconomics	LARGE Beneficial	LARGE Beneficial	MODERATE Beneficial	MODERATE Beneficial
Aesthetics	SMALL	MODERATE	SMALL	SMALL to MODERATE
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	LARGE Beneficial	LARGE Beneficial	MODERATE Beneficial	MODERATE Beneficial





## Staff Conclusion Regarding Coal, Natural Gas, and Combination of Generation Alternatives

- From an environmental perspective, none of the viable energy alternatives is preferable to construction of a new base load nuclear power plant



# Plant Design Alternatives

- Heat Dissipation Systems

- Once-through
- Wet mechanical draft
- Wet natural draft
- Wet-dry hybrid
- Dry towers
- Cooling ponds
- Spray canals



# Plant Design Alternatives

- Circulating Water Systems
  - Intake
  - Discharge
  - Water Supply
  - Water Treatment



# Staff Conclusion Regarding Plant Design Alternatives

- From an environmental perspective, none of the plant design alternatives are preferable to the proposed plant design.



# Entergy's Steps in Selecting Alternative Sites

- Define region of interest (Entergy selected sites of 7 of its operating nuclear power plants – ANO, Grand Gulf, FitzPatrick, Indian Point, Pilgrim, Riverbend, and Waterford-3)
- Indian Point eliminated because of population density
- Initial screening using Entergy assigned criteria and scores reduced 6 sites to 4 by eliminating ANO and Waterford-3
- Final screening resulted in Grand Gulf as the preferred ESP site



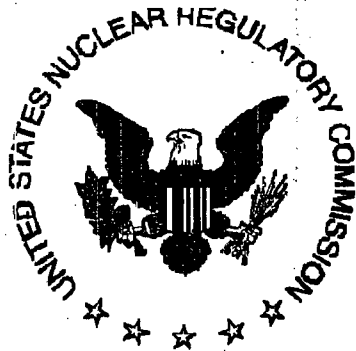
# Entergy's Initial Screening Criteria for Selecting an ESP Site

Initial Screening Criteria	Relative Weighting Factor
Seismic Evaluation	7.2
Demographic Changes	6.1
Emergency Planning	5.6
Exclusion Area	6.1
Transmission Access	8.2
Power Pricing	9.1
Water Availability	7.1
Permitting/Licensing Status	6.4
Plans for Existing Units	3.0
Spent Fuel Storage	2.6
Public Acceptance	6.6



## Entergy's Final Screening Criteria for Selecting an ESP Site

Final Screening Criteria	Weighting Factor
Geology/Seismology	3.77
Cooling System Requirements	3.27
Flooding	2.4
Nearby Hazardous Land Uses	3.35
Extreme Weather Conditions	2.36
Accident Effect-Related	4.09
Surface-Water Radionuclide Pathway	2.5
Groundwater Radionuclide Pathway	2.55
Air Radionuclide Pathway	2.5
Air-Food Ingestion Pathway	2.5
Surface-Water-Flood Radionuclide Pathway	2.41



## Entergy's Final Screening Criteria for Selecting an ESP Site (cont'd)

Final Screening Criteria	Weighting Factor
Transportation Safety	2.14
Disruption of Important Aquatic and Marine Species or Habitats	2.64
Bottom Sediment Disruption Effects	2.14
Disruption of Important Plant and Animal Species	3.18
Dewatering Effect on Adjacent Wetlands	2.77
Thermal Discharge Effects	3.64
Entrainment and Impingement Effects	3.23
Dredging and Disposal Effects	2.36
Cooling Tower Drift Effects on Surrounding Areas	2.36





## Entergy's Final Screening Criteria for Selecting an ESP Site (cont'd)

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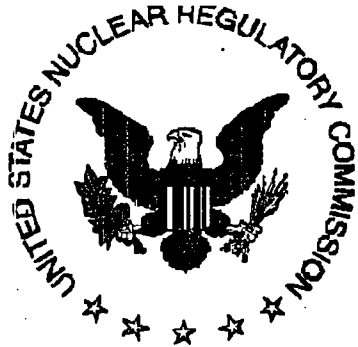
Final Screening Criteria	Weighting Factor
Socioeconomics	2.0
Environmental Justice	1.95
Water Supply	3.7
Pumping Distance	3.05
Flood Mitigation	2.9
Vibratory Ground Motion	4.0
Soil Stability	3.4
Railroad Access	2.6
Highway Access	2.8
Barge Access	2.85



## Entergy's Final Screening Criteria for Selecting an ESP Site (cont'd)

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Final Screening Criteria	Weighting Factor
Transmission	4.8
Topography	2.55
Land Rights	2.75
Labor Rates	3.3



## Staff Conclusion Regarding Site Screening

- The Applicant's overall site selection process for alternative sites was reasonable and the identification of Grand Gulf as the preferred ESP site was consistent with the Applicant's approach



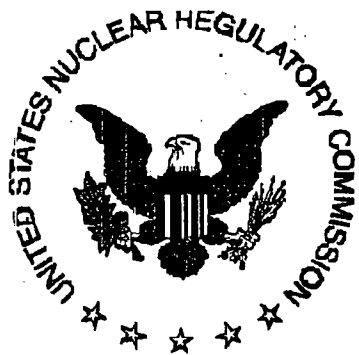
## Staff Characterization of Construction Impacts at the Alternative ESP Sites

Impact Category	River Bend	Pilgrim	FitzPatrick
Land Use Site and vicinity Power transmission line rights-of-way and offsite areas	SMALL SMALL	SMALL SMALL to MODERATE	SMALL SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL
Water-Related Water use Water quality	SMALL SMALL	SMALL SMALL	SMALL SMALL
Ecological Terrestrial ecosystems Aquatic ecosystems Threatened and endangered species	MODERATE SMALL SMALL to MODERATE	SMALL SMALL MODERATE to LARGE	MODERATE to LARGE SMALL SMALL



## Staff Characterization of Construction Impacts at the Alternative ESP Sites (cont'd)

Impact Category	River Bend	Pilgrim	FitzPatrick
Socioeconomic Physical Demography Social and economic	SMALL SMALL LARGE Beneficial to SMALL Beneficial	SMALL SMALL MODERATE Beneficial to MODERATE Adverse	SMALL SMALL MODERATE Beneficial to SMALL Beneficial
Infrastructure and Community Services	SMALL to MODERATE	MODERATE	SMALL to MODERATE
Historic and Cultural Resources	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL
Nonradiological Health Impacts	SMALL	SMALL	SMALL
Radiological Health Impacts	SMALL	SMALL	SMALL



## Staff Characterization of Operational Impacts at the Alternative ESP Sites

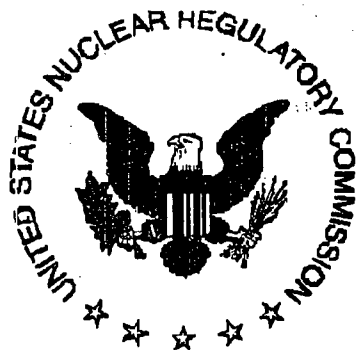
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Impact Category	River Bend	Pilgrim	FitzPatrick
Land Use Site and vicinity Power transmission line rights-of-way and offsite areas	SMALL SMALL	SMALL SMALL	SMALL SMALL
Air Quality	SMALL	SMALL	SMALL
Water-Related Water use Water quality	SMALL SMALL	SMALL SMALL	SMALL SMALL
Ecological Terrestrial ecosystems Aquatic ecosystems Threatened and endangered species	SMALL SMALL SMALL	SMALL to MODERATE SMALL to MODERATE SMALL to MODERATE	SMALL SMALL SMALL



## Staff Characterization of Operational Impacts at the Alternative ESP Sites (cont'd)

Impact Category	River Bend	Pilgrim	FitzPatrick
Socioeconomic Physical Demography Social and economic	SMALL SMALL LARGE Beneficial to SMALL Beneficial	SMALL to MODERATE SMALL MODERATE Beneficial to MODERATE Adverse	SMALL SMALL MODERATE Beneficial to SMALL Beneficial
Infrastructure and Community Services	SMALL to MODERATE	MODERATE	SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL
Nonradiological Health Impacts	SMALL	SMALL	SMALL
Radiological Health Impacts	SMALL	SMALL	SMALL
Impacts of Postulated Accidents	SMALL	SMALL	SMALL



## Comparison of the Construction Impacts at the Proposed and Alternative ESP Sites

Impact Area Category	Grand Gulf	River Bend	Pilgrim	FitzPatrick
Land Use Site and vicinity Power transmission line rights-of-way and offsite areas	SMALL SMALL	SMALL SMALL	SMALL SMALL to MODERATE	SMALL SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL	SMALL
Water-Related Water use Water quality	SMALL SMALL	SMALL SMALL	SMALL SMALL	SMALL SMALL
Ecological Terrestrial ecosystems  Aquatic ecosystems Threatened and endangered species	MODERATE  SMALL SMALL	MODERATE  SMALL SMALL to MODERATE	SMALL  SMALL MODERATE to LARGE	MODERATE to LARGE SMALL SMALL





## Comparison of the Construction Impacts at the Proposed and Alternative ESP Sites (cont'd)

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Impact Area Category	Grand Gulf	River Bend	Pilgrim	FitzPatrick
Socioeconomic Physical impacts Demography Social and economic	SMALL LARGE LARGE Beneficial	SMALL SMALL LARGE Beneficial to SMALL Beneficial	SMALL SMALL MODERATE Beneficial to MODERATE Adverse MODERATE	SMALL SMALL MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	MODERATE	SMALL to MODERATE	MODERATE	SMALL to MODERATE
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	LARGE Beneficial	SMALL	SMALL	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL



## Comparison of the Operational Impacts at the Proposed and Alternative ESP Sites

Impact Area Category	Grand Gulf	River Bend	Pilgrim	FitzPatrick
Land Use Site and vicinity Power transmission line rights-of-way and offsite areas	SMALL SMALL	SMALL SMALL	SMALL SMALL	SMALL SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL
Water-Related Water use Water quality	SMALL SMALL	SMALL SMALL	SMALL SMALL	SMALL SMALL
Ecological Terrestrial ecosystems Aquatic ecosystems Threatened and endangered species	SMALL SMALL SMALL	SMALL SMALL SMALL	SMALL to MODERATE SMALL to MODERATE SMALL to MODERATE	SMALL SMALL SMALL



## Comparison of the Operational Impacts at the Proposed and Alternative ESP Sites (cont'd)

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Impact Area Category	Grand Gulf	River Bend	Pilgrim	FitzPatrick
Socioeconomic Physical impacts Demography Social and economic  Infrastructure and community services	SMALL LARGE LARGE Beneficial	SMALL SMALL LARGE Beneficial to SMALL Beneficial SMALL to MODERATE	SMALL to MODERATE SMALL MODERATE Beneficial to MODERATE Adverse MODERATE	SMALL SMALL MODERATE Beneficial to SMALL Beneficial SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	LARGE Beneficial	SMALL	SMALL	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Impact of Postulated Accidents	SMALL	SMALL	SMALL	SMALL



## Summary of Environmental Significance of Nuclear Power Plant Construction and Operation at the Grand Gulf ESP Site, at Alternative Sites, and for the No-Action Alternative

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Impact Category	Proposed Action	No-Action Alternative	Alternative Site Options		
	ESP at Grand Gulf	Denial of ESP	River Bend	Pilgrim	FitzPatrick
Land Use	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL TO MODERATE
Ecology	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL to LARGE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Radiological and Nonradiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomic	LARGE Beneficial	SMALL	LARGE Beneficial to MODERATE Adverse	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to MODERATE Adverse



## Summary of Environmental Significance of Nuclear Power Plant Construction and Operation at the Grand Gulf ESP Site, at Alternative Sites, and for the No-Action Alternative (cont'd)

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Impact Category	Proposed Action	No-Action Alternative	Alternative Site Options		
	ESP at Grand Gulf	Denial of ESP	River Bend	Pilgrim	FitzPatrick
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	LARGE Beneficial	SMALL	SMALL	SMALL	SMALL



## Staff Conclusion Regarding Alternative Sites

- While there are some differences in environmental impacts at the proposed and alternative ESP sites, none of the differences is sufficient to conclude that any of the alternative sites is environmentally preferable to the proposed Grand Gulf ESP site