

ENVIRONMENTAL STANDARD REVIEW PLAN

FOR ES SECTION 9.3.2 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS:  
CIRCULATING WATER SYSTEMS

- 9.3.2.1 Intake Systems
- 9.3.2.2 Discharge Systems
- 9.3.2.3 Water Supply
- 9.3.2.4 Water Treatment

REVIEW INPUTS

Environmental Report Sections

- 3.3 Station Water Use
- 3.4 Heat Dissipation System
- 10.2 Station Design Alternatives: Discharge System
- 10.3 Station Design Alternatives: Intake System
- 10.5 Station Design Alternatives: Biocide Treatment

Environmental Reviews

- 2.3 Water
- 2.4 Ecology
- 3.3 Plant Water Use
- 3.4 Cooling System
- 4.2 Hydrological Alterations and Water-Use Impacts (Construction)
- 4.3 Ecological Impacts (Construction)
- 4.6 Measures and Controls to Limit Adverse Impacts during Construction
- 5.2 Hydrological Alterations, Plant Water Supply and Water-Use  
Impacts (Operation)
- 5.3 Cooling System Impacts (Operation)
- 5.10 Measures and Controls to Limit Adverse Impacts During Operation

Standards and Guides

Federal, State, and local regulations on water use, water quality,  
and effluent discharge  
Fish and Wildlife Coordination Act of 1958  
Marine Sanctuaries Act of 1972  
Coastal Zone Management Act of 1972  
Federal Water Pollution Control Act Amendments of 1972  
Endangered Species Act of 1973  
Second Memorandum of Understanding Between NRC and EPA, December 1975  
Memorandum of Understanding Between NRC and Army Corps of Engineers,  
August 1975

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Other

The site visit  
 Responses to requests for additional information  
 Consultation with local, State, and Federal agencies  
 Federal and State hydrological records and studies

REVIEW OUTPUTSEnvironmental Statement Sections

9.3.2 Alternative Plant and Transmission Systems:  
 Circulating Water Systems

Other Environmental Reviews

4.6 Measures and Controls to Limit Adverse Impacts During Construction  
 5.10.2 Measures and Controls to Limit Adverse Impacts During Operation  
 10.1 Unavoidable Adverse Environmental Impacts  
 10.4 Benefit-Cost Balance

I. PURPOSE AND SCOPE

The purpose of this environmental standard review plan (ESRP) is to direct the staff's analysis of alternatives to the applicant's proposed circulating water systems. This includes evaluation of these alternatives, in comparison with the proposed system, to identify those systems that are (1) environmentally preferable to the proposed system and (2) environmentally equivalent to the proposed system. Environmentally preferable alternatives will be compared with the proposed system on a benefit/cost basis to determine if any such system should be recommended for consideration as a preferred alternative to the proposed system.\*

The scope of the review directed by this plan will be limited to alternative circulating water systems considered feasible for construction and operation at the proposed plant site and that (1) are not prohibited by local, State, or Federal regulations, (2) are consistent with any FWPCA findings, and (3) can be judged

\* The review of environmentally preferable circulating water systems will include both environmental and economic considerations. The activities and inputs of two or more reviewers will be required in conducting this portion of the review.

as practical from a technical standpoint with respect to the proposed dates of plant construction and operation. This review will also include the investigation of alternatives proposed by other reviewers to mitigate impacts associated with construction and operation of the proposed circulating water system. The review will include (1) alternative intake designs and locations, (2) alternative discharge designs and locations, (3) alternative water supplies, and (4) alternative water treatment. The reviewer will consider the kind and magnitude of environmental impacts and the efficiencies and economics of the alternatives.

This plan provides the basis for staff conclusions with respect to the environmental preference or equivalence of alternative circulating water systems; and, for environmentally preferable systems, conclusions and recommendations for consideration of any such systems having an equivalent or better benefit-cost balance than the proposed system.

## II. REQUIRED DATA AND INFORMATION

The kinds of data and information required will be affected by site- and station-specific factors, and the degree of detail will be modified according to the anticipated magnitude of potential impacts of the proposed systems and to the practicability of adapting the reviewed alternative to the proposed site. The following data or information will usually be required:

### A. Intake Systems

1. Sketches or preliminary designs and operational characteristics of alternative intake systems, showing the intake design and its relationship to water surface, bottom geometry, shoreline, and discharge structure (from the ER)
2. Description of alternative pumping facilities, if proposed (from the ER)
3. Description of alternative locations of the proposed intake system and pumping facility on the same waterbody (from the ER)

4. Alternative procedures and schedules for intake defouling, including any use of defouling chemicals (from the ER)

5. Descriptions and operational characteristics of any alternative trash racks, traveling screens, trash baskets, or fish return systems (from the ER)

6. Predicted physical impacts and impacts to aquatic ecosystems, including entrapment, impingement, and entrainment, for each alternative intake system (from the ER).

7. Capital, maintenance, and operating costs for each alternative intake system and costs associated with system adaptation to the proposed site (from the ER)

B. Discharge Systems

1. Sketches or preliminary designs and operational characteristics of alternative discharge systems, showing the discharge design, its location with respect to the receiving water body, and its relationship to water surface, bottom geometry, intake structure and shoreline (from the ER)

2. Description of alternative discharge lines (or canals) from the heat dissipation system to the receiving water body (from the ER)

3. Description of alternative locations of the proposed discharge system on the same water body (from the ER)

4. Estimated physical impacts and impacts to aquatic biota for each alternative discharge system (from the ER).

5. Capital, maintenance, and operating costs for each alternative discharge system and costs associated with system adaptation to the proposed site (from the ER)

C. Water Supply

1. Description of potential alternative sources of water and their availability, including location of water supply source with respect to the plant site (from ESRP 2.3.1, the ER, and consultation with local and State agencies)
2. Water availability data, including ground-water sustained yield, average surface water flows and yields, and estimates of potential water shortages associated with each alternative water supply (from ESRP 2.3.1)
3. Present and known future restrictions on use of water from alternative water sources (from the ESRPs 2.3.1 and 2.3.2)
4. Economic and environmental cost data for water delivered from each alternative source (from the ER).

D. Water Treatment

1. Description and purpose of alternative water treatment systems
  - a. For circulating water system (from the ER)
  - b. For plant (service) water system (from the ER)
2. Chemicals and additives (or mechanical treatment) to be used in each alternative water treatment system (from the ER)
3. Operating cycles for each alternative water treatment system (from the ER)
4. Capital, maintenance, and operating costs for each alternative water treatment system (from the ER and the general literature).

E. Other Data

1. Site and vicinity hydrological data (from ESRP 2.3.1)
2. Site and vicinity water use, current and projected (from ESRP 2.3.2)

3. Site and vicinity water quality criteria (from ESRP 2.3.3)
4. Site and vicinity ecological data (from ESRP 2.4).
5. Proposed circulating water system design and operation (from ESRPs 3.3.2 and 3.4)
6. Plant water use (from ESRP 3.3.1)
7. Impacts of proposed circulating water system construction and operation (from ESRPs 4.2, 4.3.2, 5.2, 5.3.1 and 5.3.2)
8. Capital, maintenance, and operating costs for the proposed intake system, discharge system, and water treatment system, and water costs for the proposed water supply (from the ER).

### III. ANALYSIS PROCEDURE

The principal objectives of this analysis procedure are (1) to provide assistance to those ES Section 4 and 5 reviewers concerned with construction or operational circulating water system impacts in identifying and verifying means to mitigate adverse impacts associated with the proposed circulating water systems and (2) to identify and analyze reasonable alternatives to the applicant's proposed systems to the extent needed to rank them from an environmental standpoint as preferable, equivalent, or inferior to the applicant's proposed system.

The depth of the analysis will be governed by the nature and magnitude of proposed circulating water system impacts predicted by the ES Section 4 and 5 reviewers. When adverse impacts are predicted, the reviewer will cooperate with these reviewers in identifying and analyzing means to mitigate these impacts. The proposed system with any verified mitigation schemes (i.e., measures and controls to limit adverse impacts) will be the baseline system against which alternative circulating water systems will be compared. The nature and adversity of the remaining unmitigated impacts for this baseline system will establish the level of analysis required in the review of alternative systems to permit staff evaluation and conclusions with respect to the environmental preference or equivalence of these alternatives. When no adverse impacts have been predicted for the proposed system, the review will be limited to an analysis of

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alternative circulating water systems in the depth necessary to judge their environmental equivalence to the applicant's proposed system.

When environmentally preferable alternatives have been identified, (see the Evaluation section of this ESRP), the review will be expanded to consider the economic costs of any such alternative. The reviewer will estimate the capital, operating, and maintenance costs for each circulating water system component considered and for each component of the proposed system. The reviewer will use these data to estimate total annual costs for each system, and will use these annual costs for economic cost comparisons. The reviewer will determine if there are any site-specific factors that might affect the costs of any alternative and will factor these increased or reduced costs into the comparison. As necessary, these cost estimates will consider allowances for additional maintenance costs when it can be shown (e.g., by operating experience) that system reliability will be lower than expected for the proposed system. This analysis will be done in consultation with appropriate ES Section 10.4 reviewers. Assistance from these reviewers will be needed to establish the economic cost data that will be used to develop a benefit-cost comparison with the baseline (proposed) circulating water system.

In this analysis, the reviewer will consider alternatives to the following components of the plant circulating water system:

- A. Intake
- B. Discharge
- C. Water supply
- D. Water treatment.

The analysis will consider only those alternatives that are applicable at the proposed site and compatible with the proposed heat dissipation system.\*

\* Alternative heat dissipation systems are the subject of the ESRP for ES Section 9.3.1. When the reviewer of that section considers potential alternative heat dissipation systems that involve circulating water system components other than those proposed, the reviewer of this plan will provide assistance in determining appropriate circulating water system components for such heat dissipation systems.

The reviewer will conduct an initial environmental screening of each alternative circulating water system to eliminate those systems (or components) that are obviously unsuitable for use at the proposed site. Factors to be considered in this initial screening include, but are not limited to, plant water requirements, site terrain and relationship to water bodies, water-body geometry, other water use, ecological considerations and legislative restrictions. Economic factors will not be used in this initial screening. Working through the NRC Environmental Project Manager (EPM), the reviewer may consult with appropriate Federal and State agencies when needed to conduct this screening. The reviewer will also consult (through the EPM) with the Environmental Protection Agency (EPA) or with those agencies responsible for the FWPCA Section 316(a) and (b) determinations to screen those alternatives that will not meet FWPCA requirements. This consultation will be guided by the provisions of the Second Memorandum of Understanding between NRC and EPA, dated December 1975. The reviewer may establish other justifiable environmental bases for rejection of a given alternative. When the reviewer rejects an alternative, that alternative needs no further consideration other than the preparation (for Section V of this ESRP) of the reasons and justification for the rejection.

The following procedure for developing the analysis of alternative circulating water systems considers both environmental and economic cost factors. In following this procedure, the reviewer will initially consider only the environmental factors and will repeat the procedure for economic factors only for those alternatives shown to be environmentally preferable by the evaluation procedures of this ESRP.

A. Intake Systems

Prior to analyzing alternative intake systems, the reviewer will consult with the appropriate ES Section 4 and 5 reviewers (1) to identify any mitigation measures proposed by these reviewers and (2) to determine if alternative intake systems have been recommended by these reviewers. The reviewer will adjust the scope of the following analysis procedure on the basis of these reviewers' assessments. In addition to any recommended mitigation measures, the reviewer will consider the following classes of alternatives:

1. Alternative intake systems (e.g., offshore vs. shoreline)
2. Proposed system design modifications (e.g., reduced intake velocity, fish-return system)
3. Alternative locations of proposed system (e.g., up/downstream, alternative water bodies)
4. Alternative procedures (e.g., screenwash operation, thermal defouling).

The reviewer will consider the following environmental impacts and economic costs or factors for each recommended mitigation measure and class of alternative:

1. Construction impacts
2. Impacts to aquatic ecology
  - a. Entrapment
  - b. Impingement
  - c. Entrainment
  - d. Other (site-specific) aquatic impacts
3. Water-use impacts, including physical impacts resulting from hydrologic alterations (e.g., breakwater construction) and impacts resulting from siting on the floodplain\*
4. Compliance with Federal, State, and local regulations
5. Capital cost, annual operating and maintenance costs, and total annual costs.

The reviewer's analysis of alternatives to the proposed intake system will consist of a comparison of the proposed system with those remaining classes of

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\* See ESRP 2.3.1 for a definition of the floodplain.

alternatives not eliminated in an initial screening. The use of a format similar to that shown in Table 9.3.2-1 is recommended. Information for this table may be prepared either in terms of absolute costs and benefits or as incremental costs and benefits referenced to the proposed intake system. The reviewer may include additional factors on a site- or system-specific basis.

#### B. Discharge Systems

Prior to analyzing alternative discharge systems, the reviewer will consult with the appropriate ES Section 4 and 5 reviewers to identify any mitigation measures proposed by these reviewers and to determine if alternative discharge systems have been recommended by these reviewers. The reviewer will adjust the scope of the following analysis procedure on the basis of these reviewer's assessments. In addition to any recommended mitigation measures, the reviewer will consider the following classes of alternatives:

1. Alternative discharge systems (e.g., submerged offshore versus shoreline) and discharge type (e.g., slot, multiport)
2. Proposed system design modifications (e.g., modified discharge velocity, screens to prevent fish entry)
3. Alternative locations of proposed discharge system (e.g., up/downstream, alternative water body).

The reviewer will consider the following environmental impacts and economic costs or factors for each of the above classes of alternatives:

1. Construction impacts
2. Impacts to aquatic ecology
3. Water-use impacts, including physical impacts of hydrological alterations and siting on the floodplain
4. Compliance with Federal, State, and local regulations
5. Capital costs, annual operating and maintenance costs, and total annual costs.

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The reviewer's analysis of alternatives to the proposed discharge system will consist of a comparison of the proposed system with those remaining classes of alternatives not eliminated in an initial screening and should be accomplished in the same manner as for intake systems. The use of a table similar to Table 9.3.2-1 is recommended.

C. Water Supply

Prior to analyzing alternative water supplies, the reviewer will consult with the appropriate ES Section 4 and 5 reviewers to identify any mitigation measures proposed by these reviewers and to determine if alternative water supplies have been recommended by these reviewers. The reviewer will adjust the scope of the following analysis procedure on the basis of these reviewer's assessments. In addition to any recommended mitigation measures, the reviewer will consider as potential alternative water sources those water bodies within reasonable proximity to the proposed plant site that are capable of supplying the plant water needs. When such water sources can be identified, the reviewer will compare them with the proposed water source using the following comparison factors:

1. Water-body location and description
2. Estimated availability of water for plant use
3. Restrictions (if any) on water use for power plant cooling
4. Estimated aquatic, terrestrial, social, and environmental impacts associated with construction, operation, and maintenance of water transport systems from the water body to the plant
5. Capital costs and operation and maintenance costs of the water transport system, including annual costs of water as delivered to the plant and costs associated with any necessary water treatment.

The use of a tabular format to accomplish this comparison is recommended. Information may be prepared either as absolute benefits and costs or as incremental benefits and costs referenced to the proposed water source.

D. Water Treatment\*

The reviewer will consider alternative water treatment systems required for plant service water treatment and for circulating water system and heat dissipation system treatment. Alternatives will be considered on the basis of systems that avoid or minimize the use of chemicals, use lesser quantities of or less toxic chemicals, or do not discharge chemical wastes directly to the environment. Unless an adverse impact attributable to the proposed plant service water treatment system has been identified, the reviewer will restrict this analysis to alternative circulating water treatment systems. The reviewer will consult with the reviewer for ES Section 3.3.3 to determine proposed water treatment systems and with the reviewer for ES Section 5.3.2.2 to determine potential impacts of discharged chemicals to aquatic biota. The reviewer will consider the following classes of alternatives:

1. Alternative water treatment systems (e.g., mechanical versus chemical)
2. Modifications to the proposed system (e.g., alternative chemicals, alternative discharge points)
3. Alternative operating procedures (e.g., shock treatment versus continuous chemical addition, modified cooling tower concentration factors).

The reviewer will determine the following environmental and economic costs or factors for each of the above classes of alternatives:

1. Impacts to aquatic ecology (e.g., chemical toxicity)

\* The reviewer will coordinate this review with the review for ES Section 9.3.3 to avoid duplication.

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2. Land-use impacts (e.g., evaporation ponds)
3. Water-use impacts (e.g., increased water use to achieve lower discharge chemical concentrations)
4. Compliance with Federal, State, and local regulations
5. Capital costs, annual operating and maintenance costs, and total annual costs.

The reviewer's analysis of alternatives to the proposed water treatment systems will consist of a comparison of the proposed system with those remaining classes of alternatives not eliminated in an initial screening and should be accomplished in the same manner as for intake systems. The use of a tabular format similar to Table 9.3.2-1 for this comparison is recommended but should include identification and quantities of chemicals used for each system.

#### IV. EVALUATION

The reviewer will ensure that each circulating water system alternative has been described in sufficient detail to enable the reviewer to make an effective analysis and comparison of environmental impacts leading to a staff conclusion that the alternative system is environmentally preferable, equivalent or inferior to the proposed system. For those alternatives determined to be environmentally preferable, the reviewer will ensure that economic cost data are available in sufficient detail to enable the reviewer to conduct benefit-cost analyses and comparisons with the proposed system leading to a final staff recommendation for circulating water system consideration. The reviewer will also ensure that all comparisons were made on the basis of the proposed system, as supplemented with those measures and controls to limit adverse impacts proposed by the applicant and recommended by the staff. For those alternatives eliminated from consideration on the basis of land use, water use, or other initial screening criteria, the reviewer will ensure that adequate documented justification for this action has been prepared.

A. General Considerations

If a mitigation measure or alternative circulating water system is to be recommended for consideration, the reviewer must determine that the measure or system being evaluated has a lesser overall environmental impact than the proposed system, i.e., is environmentally preferable. When this is true, the economic costs of mitigation or of the alternative must result in an equivalent or improved project benefit-cost balance. When these criteria are met, the reviewer will verify those mitigation measures proposed by the reviewers for ES Sections 4 and 5 or will recommend consideration of an alternative circulating water system. The reviewer will be guided by the following general considerations:

1. The reviewer must keep in mind that an environmental review of alternative circulating water systems, if conducted in the depth applied to the review of the proposed system, would be expected to find additional impacts and/or increased severity of the impacts already predicted for the alternative. The reviewer will allow for this when evaluating the comparative environmental impacts of each proposed alternative with those of the proposed system.

2. The reviewer will ensure that the level of detail provided for each economic, environmental, and social cost estimate is commensurate with the level of importance of the related environmental impact.

3. The reviewer will adjust the economic costs of each alternative system on the basis of equivalent generating capacity.

4. The evaluation of alternative circulating water systems will require consultation and coordination with those agencies responsible for the determinations specified in Sections 316(a) and (b) of the Federal Water Pollution Control Act (FWPCA). Following the procedures described in the Analysis section of this ESRP, the reviewer will coordinate the evaluation of measures and controls to limit adverse impacts or of alternatives to avoid adverse impacts with the appropriate agency responsible for the FWPCA determinations. When consulting with the EPA or with agencies of States having NRC/State memoranda of

understanding, the reviewer will ensure that the staff analyses, evaluations, and recommendations (1) are consistent with the details of these memoranda and (2) will serve the environmental impact statement needs of these agencies. The reviewer will ensure that any staff recommendations for measures and controls to limit adverse impacts or for alternative circulating water systems that avoid adverse impacts are consistent with the FWPCA Section 316(a) and (b) determinations.

B. Measures and Controls to Limit Adverse Impacts

When considering measures recommended by the reviewers for ES Section 4 and 5 to mitigate adverse environmental impacts predicted for the proposed circulating water system, the reviewer's verification of the desirability of the measure will require the following conclusions:

1. The measure provides the desired mitigation and does not introduce other adverse environment impacts not predicted for the proposed system.
2. The measure will result in an overall benefit-cost balance equivalent to or better than that of the proposed project.
3. The measure is not precluded by Federal, State, or local regulations or ordinances.
4. The measure is consistent with any FWPCA Section 316(a) and (b) findings.

C. Alternative Circulating Water Systems

1. The initial step in the evaluation of those alternative intake systems, discharge systems, water supplies, or water treatment systems identified by the analysis procedure of this ESRP will be to categorize these systems as environmentally preferable, equivalent, or inferior to the proposed circulating water systems as modified by measures and controls to limit adverse impacts. The following criteria will be applied to this evaluation:

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a. When the reviewer determines that the proposed system (with mitigation measures, if necessary) will have no unavoidable adverse impacts and the system will comply with the requirements of the FWPCA, the reviewer will conclude that there can be no environmentally preferable alternatives. When this conclusion is reached, the reviewer will evaluate the alternatives to identify those that may be considered environmentally equivalent. For this condition, environmental equivalence will require that an alternative may have no unavoidable adverse impacts and meet FWPCA requirements. The reviewer will not indicate a preference between environmentally equivalent alternatives nor will a benefit-cost analysis be made when this condition prevails. Alternatives having unavoidable adverse environmental impacts or that do not meet FWPCA requirements will be judged environmentally inferior to proposed circulating water systems meeting these conditions.

b. When the reviewer determines that the proposed circulating water system will meet FWPCA requirements but is predicted to have unavoidable adverse environmental impacts, the reviewer will evaluate the identified alternative systems for potential environmental preference to the proposed system. The scope and extent of this evaluation will depend on the nature and magnitude of the proposed system's environmental impacts. An environmental review for the alternatives may be required following the analysis and evaluation procedures of the appropriate ES Section 4 and 5 ESRPs. The following criteria apply to this evaluation:

(1) Environmental preference will be established when an alternative can be shown to have no unavoidable adverse impacts and will meet FWPCA requirements.

(2) Environmental preference may be established when an alternative that meets FWPCA requirements can be shown to have unavoidable adverse impacts that are less severe in both nature and magnitude than those of the proposed system. Determination of environmental preference under these conditions will require consultation with the NRC Environmental Project Manager and the

appropriate ES Section 4 and 5 reviewers. This consultation will result in a joint determination of the status of any such alternative.

(3) Environmental equivalence will be established when an alternative that meets FWPCA requirements can be shown to have unavoidable adverse impacts of the same or equivalent nature and magnitude as those of the proposed system.

(4) Environmental inferiority will be established when an alternative can be shown to have unavoidable adverse impacts that are more severe in both nature and magnitude than those of the proposed system, or that will not meet FWPCA requirements.

When the reviewer determines that there are environmentally preferable alternatives to the proposed circulating water system, the reviewer will conduct those portions of the analysis instructions of this ESRP that deal with the economic costs of the alternative systems.

2. When environmentally preferable alternative circulating water systems have been identified, the reviewer will ensure that economic cost data have been developed for the alternatives and that these data are adequate for a benefit-cost analysis and comparison with the proposed system. This portion of the evaluation procedure will be conducted with the assistance of appropriate ES Section 10.4 reviewers. The reviewer will complete the economic and reliability portions of Table 9.3.2.-1. On the basis of the completed table, the reviewer will balance and compare benefits and costs of the environmentally preferable alternative(s) with those of the proposed system. When an environmentally preferable alternative can be shown to have the same or greater benefits in terms of electrical output as the proposed system with comparable reliability and at the same or lesser economic costs, the reviewer may conclude that the alternative should be recommended for consideration as an alternative to the proposed system. For those cases where benefits of the alternative are less than those of the proposed system (e.g., lower electrical output or decreased reliability) or where economic costs are greater than those of the proposed system, a conclusion that

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the alternative to be recommended will require consultation with the NRC Environmental Project Manager and with the appropriate ES Section 4 and 5 reviewers. If this consultation establishes that the benefit-cost balances of such alternatives are no more than equivalent to the proposed system, the alternatives will not be recommended for further consideration. When alternatives have significantly decreased benefits or increased economic costs, they will be rejected for any further consideration as alternatives to the proposed systems.

#### V. INPUT TO THE ENVIRONMENTAL STATEMENT

This section of the environmental statement should be planned to accomplish the following objectives: (1) description of alternative circulating water systems considered and results of the staff's analysis of these alternatives, (2) presentation of the basis for the staff's analysis, and (3) presentation of the staff's conclusions and recommendations relative to alternative circulating water systems.

The reviewer will prepare separate inputs describing the review and analysis of alternative intake systems, discharge systems, water supplies, and water treatment systems. If desired, each input may be prepared as a separate ES section (e.g., 9.3.2.1, Alternative Intake Systems). Each of these inputs to the environmental statement will normally describe (1) those alternatives considered, (2) those alternatives rejected by the staff as being inappropriate for the proposed site, (3) the staff's analysis and comparison of potentially appropriate alternatives to seek environmentally preferable alternatives to the proposed system, and (4) the staff's conclusions and recommendations (where applicable) for consideration of alternative systems.

The reviewer will discuss briefly those alternatives rejected because of specific deficiencies and will state why the alternative system was rejected. The reviewer will also identify those alternatives judged environmentally equivalent or inferior to the proposed system. The use of tables similar to Table 9.3.2-1 to present the staff's comparison of potentially acceptable alternative circulating water systems is recommended. When the reviewer has concluded that an alternative is environmentally preferable and should be considered as a preferred circulating water system, sufficient additional detail should be

presented to justify the alternative both environmentally and on a benefit-cost basis.

The reviewer will provide inputs or ensure that inputs will be made to the following ES sections:

A. Sections 4.6 and 5.10. The reviewer will provide the reviewers for ES Sections 4.6 and 5.10, as appropriate, with a list of those measures and controls to limit adverse impacts that were developed as a result of this review of circulating water system alternatives.

B. Section 10. When the reviewer has recommended consideration of an alternative circulating water system or system component, data and information will be provided to the appropriate ES Section 10 reviewers to permit the inclusion of any such alternatives in the final evaluation of the proposed action.

#### VI. REFERENCES

1. Pagano, R., and W. H. B. Smith, Recent Developments in Techniques to Protect Aquatic Organisms at the Water Intakes of Steam-Electric Power Plant, MITRE Technical Report 7671, METREK Division of the MITRE Corporation, McLean, Virginia, November 1977.
2. Development Document for Best Technology Available for the Location, Design, Construction and Capacity of Cooling Water Intake Structures for Minimizing Adverse Environmental Impact, EPA 440/1-76/015-a, U.S. Environmental Protection Agency, Washington, D.C., April 1976.
3. A State-of-the-Art Report on Intake Technologies, EPA-600/7-76-020, U.S. Environmental Protection Agency, Washington, D.C., October 1976.
4. White, J. C., Jr., and M. L. Brehmer, Eighteen-Month Evaluation of the Restroph Traveling Fish Screens, pp. 367-380 In: L. D. Jensen (Ed). Third National Workshop on Entrainment and Impingement, Ecological Analysts, Inc., Melville, N.Y. 1976.

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5. Reviewing Environmental Impact Statements--Power Plant Cooling Systems, Engineering Aspects, EPA 660/2-73-016, Pacific Northwest Environmental Research Laboratory, Corvallis, OR, 1973.
6. L. Schreiber, C. Becker, J. Fuguay, and A. Chitwood, "Intake System Assessment for Central Columbia River," Journal of the Power Division, ASCE, Vol 100, No. P02, Proc. Paper 11001, pp. 139-155, December 1974.
7. J. C. Sonnichsen, Jr., B. W. Bentley, G. F. Bailey, and R. E. Nakatani, A Review of Thermal Power Plant Intake Structure Designs and Related Environmental Considerations, HEDL-TME-73-24, Hanford Engineering Development Laboratory, Richland, WA 1973.
8. Lake Michigan Cooling Water Intake Technical Committee, Lake Michigan Intakes: Report on the Best Available Technology, LMCWITC, 1973.
9. R. T. Richards, and M. J. Hroncich, "Perforated-Pipe Water Intake for Fish Protection," J. Hydraulics Division, ASCE, pp. 139-149, 1975.

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