ENVIRONMENTAL STANDARD REVIEW PLAN

FOR ES SECTION 9.3.1 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS: HEAT DISSIPATION SYSTEMS

REVIEW INPUTS

Environmental Report Sections

3.4	Heat Dissipation System
10.1	Station Design Alternatives: Circulating System

Environmental Reviews

2.2.1	Land: The Site and Vicinity
2.3	Water
2.4	Ecology
2.7	Meteorology
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)
5.8	Socioeconomic Impacts (Operation)
5.10	Measures and Controls to Limit Adverse Impacts During Operation

Standards and Guides

Federal, State, and local regulations on water use, air and water quality, effluent discharge, and land use
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
Regulatory Guide 4.8, "Preparation of Environmental Technical Specifications for Nuclear Power Plants"
Second Memorandum of Understanding Between NRC and EPA, December 1975.
Memorandum of Understanding Between NRC and the Army Corps of Engineers, August 1975.

Other

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

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REVIEW OUTPUTS

Environmental Statement Sections

9.3.1	Alternative Plant and Transmission Systems: Heat Dissipation Systems

Other Environmental Reviews

4.6	Measures and Controls to Limit Adverse Impacts during Construction
5.10	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 heat dissipation system. 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 heat dissipation 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 as practical from a technical standpoint with respect to the proposed

*The review of environmentally preferable heat dissipation 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.

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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 heat dissipation system.

This plan provides the basis for staff conclusions with respect to the environmental preference or equivalence of alternative heat dissipation 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 practicality of adapting the potential alternative to the proposed site. The following data or information will usually be required:

A. For the proposed heat dissipation system and for each potential alternative:

1. Land-use requirements (from ESRP 3.1 and the ER)

2. Water-use requirements (from ESRP 3.3.1 and the ER)

3. Operating and maintenance experience for similar units (from the ER and the general literature)

4. Capital, maintenance, and operating costs (from the ER and the general literature)

5. Effect on generating efficiency (from the ER and the general literature)

6. Predicted thermal and physical effects, e.g., thermal plume, scouring (from ESRPs 5.3.1.1 and 5.3.2.1 and the ER)

7. Predicted atmospheric effects, e.g., fogging, icing, drift (from ESRP 5.3.3.1 and the ER)

8. Predicted operating noise levels (from ESRP 5.8.1 and the general literature)

9. Predicted esthetic effect, e.g., visual plumes (from the ER)

10. Predicted recreational benefits (from the ER)

B. Site and vicinity land use, current and projected (from ESRP 2.2.1)

C. Site and vicinity hydrological data (from ESRP 2.3.1)

D. Site and vicinity water use, current and projected (from ESRP 2.3.2)

E. Site and vicinity water quality criteria (from ESRP 2.3.3)

F. Site and vicinity ecological data (from ESRP 2.4)

G. Site and vicinity meteorological characteristics (from ESRP 2.7).

III. ANALYSIS PROCEDURE

The principal objectives of this analysis procedure are (1) to provide assistance to those ES Sections 4 and 5 reviewers concerned with construction or operational heat dissipation system impacts in identifying and verifying means to mitigate adverse impacts associated with the proposed heat dissipation system and (2) to identify and analyze reasonable alternatives to the applicant's proposed system 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 heat dissipation system impacts predicted by the ES Sections 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 heat dissipation 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. This will 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 alternative heat dissipation 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. 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) heat dissipation system.

The reviewer will consider the following classes of heat dissipation systems (additional systems, e.g., a combined tower/pond system, may be considered when site-specific conditions suggest that such a system would be environmentally preferable to the proposed system):

A. Once-through systems

B. Closed-cycle systems

1. Mechanical-draft wet cooling towers (including circular towers)
2. Natural-draft cooling towers (including fan-assisted towers)
3. Wet-dry cooling towers

4. Dry cooling towers
5. Cooling ponds
6. Spray ponds.

The reviewer will consider these alternatives for construction and operation at the applicant's proposed site. The analysis will include intake and discharge system environmental impacts (and economic costs) when these systems would need to be substantially different than those associated with the proposed heat dissipation system.

The reviewer will conduct an initial environmental screening of each alternative heat dissipation system to eliminate those systems that are obviously unsuitable for use at the proposed site. Factors to be considered in this initial screening are land use (e.g., site size and terrain), water use (e.g., availability of cooling water), 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 the 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 heat dissipation 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. The analysis of those alternative heat dissipation systems not

eliminated by the initial screening process will be based on the environmental and economic factors shown in Table 9.3.1-1. The reviewer will prepare a similar table for the heat dissipation systems under consideration, comparing each of the environmental and economic cost and benefit factors with those of the proposed heat dissipation system. Information for this table may be prepared either in terms of absolute environmental and economic costs and benefits or as incremental costs and benefits referenced to the proposed system. Additional factors may be included when needed on a site- or system-specific basis. Preparation of this table will involve the following:

1. Land Use. The reviewer will determine (a) the onsite land-use requirements of each system; (b) the practicality of heat dissipation system construction and operation within the specifics of site area, terrain, and the impacts of social and economic land-use costs; (c) the extent to which any system is sited on or results in modifications to the floodplain;* and (d) the impacts to terrestrial biota associated with system construction and operation. The reviewer will consult with the reviewers for ES Sections 2.2.1, 2.3.1, 4.1.1, 4.3.1, 5.1.1, and 5.3.3 to develop the comparative land-use and ecological impact data.

2. Water Use. The reviewer will determine (a) the water-use requirements of each system, including intake requirements, water consumption, and intake/discharge water quality and quantity, (b) the practicality of this water use within the specifics of water availability and the impacts of present and known future water uses, and (c) the impacts of aquatic biota associated with system construction and operation. The reviewer will compare these data with characteristics of the proposed heat dissipation system. The economic cost of water consumed will be considered when this data is available. The reviewer will consult with the reviewers for ES Sections 2.3, 4.2.2, 4.3.2, and 5.2.2 to develop the comparative water quality, water use, and ecological impact data.

3. Atmospheric Effects. The reviewer will determine the predicted atmospheric effects of each alternative heat dissipation system (e.g., the extent

* See ESRP 2.3.1 for a definition of the floodplain.

and magnitude of cooling tower drift) and compare these effects with those of the proposed system. The reviewer will consult with the reviewers for ES Sections 2.7 and 5.3.3 to develop this comparison, which may be based on verified applicant-supplied data or on independent staff estimations of atmospheric effects.

4. Thermal and Physical Effects. The reviewer will estimate the predicted thermal and physical effects (e.g., thermal plumes, erosion, scouring) of each alternative heat dissipation system, and will compare these effects with those of the proposed system. The reviewer will consult with the reviewers for ES Sections 2.3.1, 4.2.1, and 5.2.1 for assistance in making this comparison.

5. Noise Levels. The reviewer will estimate operational noise levels for each of the alternatives and will compare them with the predicted operating noise levels of the proposed system and with any local or State restrictions. The reviewer will consider construction noise levels when these could be significant.

6. Esthetics and Recreational Benefits. The reviewer will compare the esthetic impacts and potential recreational benefits of each alternative system with those of the proposed system. The reviewer will consult with the reviewers for ES Sections 2.5, 3.1, and 5.8 for assistance in making this comparison.

7. Operating and Maintenance Experience. The reviewer will compare operating and maintenance experience of each alternative with the proposed system to develop a projected reliability factor for each system.

8. Generating Efficiency. The reviewer will estimate the plant electrical generation efficiency for each alternative heat dissipation system and will compare it with the generating efficiency using the proposed system.

9. Costs. The reviewer will estimate the capital, operating, and maintenance costs for the proposed system and for each alternative considered. The reviewer will use these figures 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 additional costs into the comparison.

10. Other Considerations. When an alternative heat dissipation system will involve the use of intake or discharge systems that would be substantially different from the proposed system, the reviewer will repeat the above procedures for both intake and discharge systems. This should supplement the appropriate environmental and economic cost factors, as needed, to account for any differing intake and discharge system effects. This procedure will involve consultation with the reviewer for ES Section 9.3.2.

IV. EVALUATION

The reviewer will ensure that each heat dissipation 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 heat dissipation 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 legislative restrictions, the reviewer will ensure that adequate documented justification for this action has been prepared.

A. General Considerations

If a mitigation measure or alternative heat dissipation 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 heat dissipation system. The reviewer will be guided by the following general considerations:

1. The reviewer must keep in mind that an environmental review of alternative heat dissipation 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 heat dissipation 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 heat dissipation 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 Sections 4 and 5 to mitigate adverse environmental impacts predicted for the proposed heat dissipation 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 environmental 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 Heat Dissipation Systems

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

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 heat dissipation system 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 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 heat dissipation systems meeting these conditions.

b. When the reviewer determines that the proposed heat dissipation 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 Sections 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 Sections 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 heat dissipation 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 heat dissipation 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 9.3.1.-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 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 the 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 the alternative is to be recommended will require consultation with the NRC Environmental Project Manager and with the appropriate ES Sections 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 system.

V. INPUT TO THE ENVIRONMENTAL STATEMENT

This section of the environmental statement should be planned to accomplish the following objectives: (1) description of alternative heat dissipation 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 heat dissipation systems.

The input to the environmental statement will usually describe (1) those alternatives considered by the staff, (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 heat dissipation system, and (4) the staff's conclusions and recommendations (where applicable) for consideration of alternative heat dissipation systems. Staff contacts with the EPA or with agencies responsible for FWPCA determinations will be referenced.

The reviewer will discuss briefly those alternatives rejected because of specific deficiencies and state why the alternative was rejected. The reviewer will also identify those alternatives judged environmentally equivalent or inferior to the proposed system. The use of a table similar to Table 9.3.1-1 to present the staff's comparison of these potentially acceptable alternative heat dissipation systems is recommended. When the reviewer has concluded that an alternative is environmentally preferable and should be considered as the preferred heat dissipation 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 heat dissipation system impacts that were developed as a result of this environmental review.

B. Section 10. When the reviewer has recommended consideration of an alternative heat dissipation system, 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

NUREG-0038 "Draft Environmental Statement for Selection of the Preferred Closed-Cycle Cooling System at Indian Point Unit No. 2," USNRC, February 1976.

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TABLE 9.3.1-1

COMPARISON OF ALTERNATIVE HEAT DISSIPATION SYSTEMS

	Proposed System	Once-Through	Mechanical Draft	Natural Draft	Wet-Dry Towers	Dry Towers	Cooling Ponds	Spray Ponds
Land Use (hectares)								
Land Use (Environmental Impact)								
Water Use (m^3/sec)								
a) Intake								
b) Discharge								
Water Use (Environmental Impact)								
Atomospheric Effects								
Noise Levels								
Esthetics								
Recreational Benefits								
Net Plant Output (Mw)								
Generating Efficiency								
Operating and Maintenace Experience (reliability)								
Capital Cost ($)								
Annual Operating and Maintenance Cost ($)								
Total Annual Cost ($)								