Section 9.3.4 February 1979

ENVIRONMENTAL STANDARD REVIEW PLAN

FOR ES SECTION 9.3.4

ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS: TRANSMISSION SYSTEMS

- 9.3.4.1 Alternative Routes
- 9.3.4.2 Alternative Design, Construction, and Maintenance

REVIEW INPUTS

Environmental Report Sections

- Regional Historic, Archeological, Architectural, Scenic,
- Cultural, and Hatural Features
- 3.9 Transmission Facilities
- 4.2 Transmission Facilities Construction
- 5.5 Effects of Operation and Maintenance of the Transmission Systems
- 10.9 Station Design Alternatives: Transmission Facilities

Environmental Reviews

- 2.2.2 Land: Transmission Corridors and Offsite Areas
- 2.4.1 Terrestrial Ecology
- 2.4.2 Aquatic Ecology
- 2.5.3 Historic and Archeological Sites and Natural Landmarks
- 3.7 Power-Transmission Systems
- 4.1.2 Land-Use Impacts: Transmission Corridors and Offsite Areas (Construction)
- 4.1.3 Land-Use Impacts Historic/Archeological Sites (Construction)
- 4.3.1 Ecological Impacts Terrestrial Ecosystems (Construction)
- 4.3.2 Ecological Impacts Aquatic Ecosystems (Construction)
- 4.4.1 Socioeconomic Impacts: Physical
- 4.6 Measures and Controls to Limit Adverse Impacts During Construction
- 5.1.2 Land-Use Impacts: Transmission Corridors and Offsite Areas (Operation)
- 5.6 Transmission System Impacts (Operation)
- 5.10 Measures and Controls to Limit Adverse Impacts During Operation
- 8.1 Description of the Power System

Standards and Guides

Department of Interior and Department of Agriculture, Environmental

Criteria for Electric Transmission Systems, U.S. GPO 0-446-290, 1971.

- FPC, Electric Power Transmission and the Environment, Protection and Enhancement of Natural Scenic Values in the Design, Location, and Operation of Project Work, November 27, 1974.
- U.S. Nuclear Regulatory Commission, "Alternative Electrical Transmission Systems and their Environmental Impact," NUREG-0316, August 1977.

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Other

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

REVIEW OUTPUTS

Environmental Statement Sections

9.3.4 Alternative Plant and Transmission Systems: Transmission 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. PUR ISE 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 transmission 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 include (1) alternative corridor routes and (2) alternatives to proposed system design, construction, and maintenance practices. The review will be limited to alternatives that (1) are applicable to and compatible with the proposed plant, the service area, and the regional transmission network, (2) are not prohibited by local, State, or

9.3.4-2

The review of environmentally preferable transmission 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.

Federal regulations, and (3) can be judged as practical from a technical standpoint with respect to the proposed dates of plant 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 transmission system.

This plan provides the basis for the staff conclusions with respect to the environmental preference or equivalence of alternative transmission 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 region-specific factors, and the degree of detail will be modified according to the magnitude of the impacts predicted for the proposed transmission system and to the practicability of adopting the alternative under consideration. The following data or information will usually be required:

A. Alternative Corridor Routes

1. Maps or aerial photographs showing alternative transmission corridors from the station site to interconnecting points on the existing high voltage system and identifying corridor characteristics, e.g., new lines/towers on existing corridors, widening of existing corridors, new corridors. (A key map providing this information will be provided in the ER. Topographic maps (7 1/2 or 15 min.) will be obtained from the applicant on request.)

2. Maps or aerial photographs showing existing and known future generating stations and transmission networks for the service area or affected region. For existing transmission corridors not proposed as alternatives to the proposed system, reasons (e.g., system reliability) why they were not considered (from the ER and through consultation with agencies such as regional power pools).

Items 3, 5, 6, and 8 (following) will not be required when the alternative route is an existing corridor containing towers and lines that will not be widened nor require new towers for use as an alternative.

3. Maps or aerial photographs showing the approximate locations of National, State, or private wild life refuges or other areas dedicated to ecological preservation, management, or study that are within 1 km of alternative corridors (from the ER and through consultation with local, State, and Federal agencies).

4. Location and description of known populations of threatened or endangered species of plants and animals occurring along alternative corridors (through consultation with local, State, and Federal agencies).

5. Location and extent of agricultural areas that are on or within 2 km of alternative corridors that are routinely serviced by aircraft, e.g. crop dusting (through consultation with local representatives of State and Federal Departments of Agriculture).

 Corridor proximity to airports, roads, railroads, or other transportation facilities (from the ER).

7. Lengths and widths (in km) of rights-of-way for each alternative segment or corridor (from the ER).

8. General land-use characteristics along the alternative corridors, expressed as percentages of total corridor length and in terms of the intensity of use (e.g., residential density) for the following classifications (from the ER and through consultation with State and Federal agrices):

- a. Agricultural
- b. Forest, woodland
- c. Rangeland

- Recreational or ecologically sensitive areas such as parks, wildlife preserves/refuges or management areas, wetlands, wild and scenic rivers
- e. Urban or residential areas
- f. Commercial or industrial areas
- g. Other potentially significant classifications (e.g., Federallyowned lands, Indian lands)
- h. Potential geologic hazards (e.g., active faults) that could affect transmission system reliability

9. Number and approximate location of known historic/archeological sites within 2 km of the alternative corridor (from the ER and through consultation with State and Federal agencies)

10. Local and State laws or regulations that affect rights-of-way acquisition, transmission line construction and operation, or corridor siting (from consultation with appropriate local and State agencies).

B. Alternative System Design, Construction, and Maintenance Practices

 Alternative voltage levels and transmission frequency that are compatible with the existing service area/regional transmission network (from the ER).

 Alternative tower designs for areas of potential visual impact (from the ER).

 Alternative tower heights and conductor-to-ground clearances (from the ER).

4. Alternative conductor designs (from the ER).

5. Undergrounding in areas of potentially high impact (from the ER).

6. Alternative construction practices, including vegetation clearing; erosion control; revegetation; access road design, location and maintenance; tower



placement, foundations, and installation; and conductor installation (from the ER and through consultation with local, State, and Federal agencies).

7. Alternative maintenance practices (from the ER and through consultation with local, State, and Federal agencies).

Alternative location of auxiliary transmission facilities, e.g., 8. substations, microwave relay stations (from the ER).

Laws or regulations that affect transmission facilities design or 9. operation (from consultation with local, State, and Federal agencies).

C. Selection Process and Cost Data

1. Discussion of the selection process used to evaluate transmission line routes and the rationale and criteria used to select the proposed route (from the ER)

Acquisition cost data for the proposed and alternative route rights-2. of-way (from the ER)

3. Construction and maintenance costs for the proposed system and for principal system alternatives (from the ER)

Estimated transmission-line losses for the proposed system and 4. for principal alternatives (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 identifying and verifying means to mitigate adverse impacts associated with the proposed transmission 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. 109 215

The depth of the analysis will be governed by the nature and magnitude of proposed transmission 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 transmission 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 alternative transmission 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) transmission system.

In this analysis, the reviewer will consider alternatives to the following elements of the proposed transmission system:

- A. Transmission corridor routes
- B. Design, construction, and maintenance.

The analysis will consider only those alternatives applicable to and compatible with the proposed plant, the applicant's service area, and the regional transmission network.

The reviewer will conduct an initial environmental screening of each alternative transmission system to eliminate those systems that are obviously unsuitable for application to the proposed project. Economic factors will not be used



109 216 9.3.4-7

in this initial screening. Working through the NRC Environmental Project Manager, the reviewer may consult with appropriate Federal and State agencies when needed to conduct this screening. When the reviewer rejects an alternative, that alternative needs no futher 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 transmission 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 transmission systems not eliminated by the initial screening process will be based on the environmental and economic factors shown in Table 9.3.4-1. The reviewer will prepare a similar table for each transmission system element under consideration, comparing each of the environmental and economic cost and benefit factors with those of the proposed transmission system element. 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.

A. Alternative Corridor Routes

The reviewer's analysis of alternative corridor routes will be based on a comparison of those routes with the proposed route described in ES Section 3.7. The comparison may be made for complete routes or for route segments, as appropriate, and will consider those factors listed in Item A of Section II of this plan.

The reviewer will consider both environmental and economic factors, using a tabular format similar to that shown in Table 9.3.4-1. The reviewer will consult with the reviewer for ES Section 3.7 and the appropriate ES Section 4 and 5 reviewers to establish construction and operation impacts for the proposed corridor routes. The reviewer's comparison of these data with those for the alternative corridors will involve the following: 109 217

1. Impacts

The reviewer will estimate the impacts that can be expected from development of alternative transmission corridors, tower and line installation, and operation and maintenance. The appropriate ES Section 4 and 5 reviewers will be consulted in making these estimates and in comparing these impacts with those predicted for the proposed corridor routes.

2. Economic Factors

The reviewer will estimate acquisition or rights-of-way costs, clearing and construction costs, maintenance costs, are e costs to mitigate predicted environmental impacts for the proposed and alternative routes. Where there are appreciable differences in transmission-line lengths, the reviewer will estimate the loss in delivered electrical capacity due to transmission-line losses.

B. <u>Alternatives to the Proposed Transmission System Design, Construction</u>, and Maintenance

The reviewer's analysis of alternatives to the proposed system design, construction, and maintenance will be based on recommendations made by the appropriate ES Section 4 and 5 reviewers for alternative actions to mitigate predicted impacts. As a general rule, these alternative designs, practimes, and procedures will fall within the categories listed in Section II.B of this LSRP. The following guidance should be considered when reviewing these alternatives:

1. Alternative voltage levels and/or d.C. versus a.C. transmission will only be considered when (a) the reviewer for ES Section 5.6.3 predicts a significant impact associated with the proposed voltage levels and frequency that cannot be mitigated by other alternatives (e.g., increased conductor-to-ground clearance, alternative routes) and (b) the alternatives are consistent with service area and regional transmission network characteristics.

2. Alternative tower designs, tower heights, conductor-to-ground clearances, conductor designs, and rights-of-way widths will be considered when the



reviewers for ES Section 5.6 predict adverse transmission system impacts (e.g., esthetic impacts, electric fields, shock hazards) that could be mitigated by alternatives to chese design parameters.

Undergrounding will be considered only for unusual circumstances where the costs associated with this practice can be justified.

4 Alternative construction practices will be considered when recommended by the reviewers for ES Sections 4.1, 4.3, and 4.4. Typical alternatives to be considered include methods for vegetation clearing; erosion control; revegetation; access-road design and use, tower locations, foundations, and installation; conductor installation; type and amount of equipment in use; and timing of coastruction activities.

The reviewer will consider alternative maintenance practices, 5 particularly with respect to corridor maintenance, when the proposed methods can be predicted to have adverse impacts associated with, e.g., terbicide drift or habitat loss due to clearcutting. The reviewer will consuit with the reviewers for ES Section 5.6 to determine the nature and scope of alternatives to be considered.

The reviewer will consider alternative locations of auxiliary trans-6. mission-system facilities only when the reviewers for ES Sections 4.1.2 or 5.1.2 recommend relocation of such facilities.

IV. EVALUATION

The reviewer will evaluate the applicant's process for identification and selection of alternative transmission system routes to ensure that reasonable alternatives to the proposed route have been considered. The reviewer will also ensure that due consideration has been given to the use of existing transmissionline corridors as an alternative to the development of new corridors. The reviewer will ensure that each transmission 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 109 219





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 transmission 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 transmission system is to be recommended for consideration, the reviewer must determine first 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 transmission system. The reviewer will be guided by the following general considerations:

1. The reviewer must keep in mind that an environmental review of alternative transmission 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.

 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.

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9.3.4-11

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 transmission system, the reviewer's varification 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.

 The measure will result in an overall benefit/cost balance equivalent to or better than that of the proposed project.

 The measure is not precluded by Federal, State or local regulations or ordinances.

C. Alternative Transmission Systems

1. The initial step in the evaluation of those alternative transmission systems identified by the analysis procedure of this ESRP will be to categorize these systems as environmentally preferable, equivalent, or inferior to the proposed transmission 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 will comply with applicable local, State, and Federal regulations, the reviewer will conclude that there can be no environmentally preferable transmission 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 applicable regulatory requirements. The reviewer will not indicate a preference between environmentally equivalent alternatives having unavoidable adverse environmental impacts or that do not meet

109 221

regulatory requirements will be judged environmentally inferior to proposed transmission systems meeting these conditions.

b. When the reviewer determines that the proposed transmission system will meet regulatory 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 regulatory requirements.

(2) Environmental preference may be established when an alternative that meets regulatory 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 NR⁷. 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 regulatory 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 comply with applicable local, State, or Federal regulations.

9.3.4-13

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

When environmentally preferable alternative transmission systems 2. 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 factors portions of Table 9.3.4-1. 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 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., increased transmission losses or decreased system 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 Section 4 and 5 reviewers. If this conclusion establishes that the benefit-cost palances 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 banefits 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 the alternative transmission corridor routes and system design, construction, and maintenance practices that were 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.

The reviewer will prepare separate inputs describing the review and analysis of alternative routes and alternative system design, construction, and maintenance. If desired, each input may be prepared as a separate Environmental Statement section, (e.g., 9.4.3.1, Alternative Routes). Each input will normally describe (1) those alternatives considered by the staff, (2) those alternatives rejected by the staff as being inappropriate for the proposed project, (3) the staff's analysis and comparison of potentially appropriate alternatives to seek environmentally preferable alternatives to the proposed system or component, and (4) the staff's conclusions and recommendations (where applicable) for consideration of alternative transmission systems. For alternative routes, the input will also include a brief description of the applicant's process for identifying and evaluating alternative routes and the staff conclusion with respect to the merits of the procedure.

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 9.3.4-1 to present the staff's comparison of these potentially acceptable alternative heat dissipation systems is recommended.

When the reviewer has concluded a alternative is environmentally preferable and should be considered as the preferred route (or route segment), design, construction practice, or maintenance technique, sufficient additional narrative detail will be included in the input to justify the alternative on an environmental and economic cost basis.

The resonance wer will provide inputs or ensure that inputs will be made to the following sections:

A. <u>Sections 4.6 and 5.10</u>. 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 transmission-system impacts that were developed as a result of this environmental review.

B. Sections 10.1 and 10.4. When the reviewer has recommended consideron of an alternative to the proposed transmission system, data and information will be provided to the reviewers of ES Sections 10.1 and 10.4 to permit the inclusion of any such alternatives in the final evaluation of the proposed action.

VI. REFERENCES

 J. R. Anderson, E. E. Hardy, J. T. Roach and R. E. Witmer, <u>A Land-Use and</u> <u>Land-Cover Classification System for Use with Remote Sensor Data</u>, Geological Survey Professional Paper 964, 1976.







TABLE 9.3.4-1

COMPARISON OF ALTERNATIVE CORRIDOR ROUTES

	Proposed Route	Alternative A	Alternative B
Factor	Or Segment	Route/Segment	Route/Segment

Descriptions

- 1. New Corridors
 - a. Tota' win (k.)

b. Fight-of-way visto (m.

- c. Total area (-a)
- d. Corridor of machenistics

(A: appropriate from Section II.A of this ESRP)
(2)
etc.

- 2. Existing (Cleared) Corridors
 - a. Total length
 - b. Right-of-way width
 - c. Total area

Impacts

- 1. Land Use (e.g., agriculture, recreational areas)
- 2. Terrestrial Ecology (e.g., habitat loss, endangered species)
- 3. Aquatic Ecology (e.g., siltation, stream crossings)
- 4. Socioeconomics (e.g., esthetics, historic sites)

Economic Factors

- 1. Estimated Acquisition Cost
- 2. Estimated Construction Costs
- 3. Estimated Maintenance Costs
- 4. Estimated Transmission Losses

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