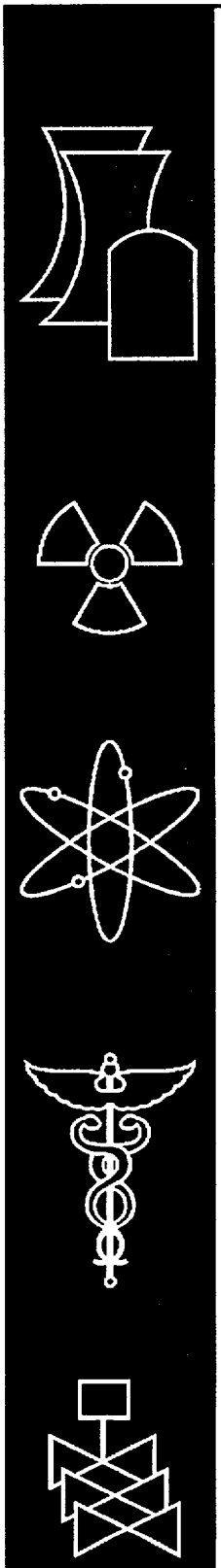

Environmental Standard Review Plan

Main Report

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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Environmental Standard Review Plan

Standard Review Plans for Environmental Reviews for Nuclear Power Plants

(Chapters 5-10 and Appendices)

Main Report

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5.0 ENVIRONMENTAL IMPACTS OF STATION OPERATION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the environmental impacts of station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.1 through 5.10.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's predicted environmental impacts of station operation is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.1 through 5.10. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.1 LAND-USE IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the land-use impacts of station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.1.1 through 5.1.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's land-use impacts is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.1.1 through 5.1.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.1.1 THE SITE AND VICINITY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

Land-use

This environmental standard review plan (ESRP) directs the staff's assessment of impacts of plant operation on land use in the vicinity of the site. The scope of the review directed by this plan should include an evaluation of plant operation in sufficient detail to determine the significance of potential land-use impacts in the vicinity of the site and to recommend how these impacts should be treated in the licensing process. Where necessary, the reviewer should recommend alternative operational modes or designs that would prevent, reduce, or mitigate adverse environmental impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.2.1. Obtain land-use description information.
- ESRP 2.4.1. Obtain information on the principal terrestrial features of the site.
- ESRP 2.6. Obtain information on geologic environmental impacts.

- ESRP 2.7. Obtain estimates of the impacts of non-radiological emissions related to plant operations on air quality.

- ESRP 3.4.1. Obtain information on the cooling system and its operational modes.

- ESRP 5.3.3. Obtain information on the heat dissipation system.

- ESRP 5.8.2. Provide information on land-use impacts associated with plant operation that may have social and economic impacts in the region surrounding the plant site.

- ESRP 5.10. Provide a list of the measures and controls to limit adverse land-use impacts that are to be recommended for consideration.

- ESRP 6.5.1. If potential adverse impacts of cooling tower drift deposition are predicted, then provide any recommended preoperational baseline monitoring-program elements.

- ESRP 9.3.1. Provide a list of adverse land-use impacts that could be avoided or mitigated through alternative heat dissipation system designs or operational procedures, and assist in determining appropriate alternatives.

- ESRP 9.4.2. Provide land-use impact information that can be used to compare alternative circulating water systems.

- ESRP 10.1. Provide a summary of the unavoidable adverse environmental impacts on land use that are predicted to occur as a result of plant operation.

- ESRP 10.2. Provide a summary of irreversible and irretrievable commitments of land-use resources that are predicted to occur as a result of plant operation.

- ESRP 10.3. Provide land-use information at the proposed site and its vicinity related to short term uses and long-term productivity of the environment.

Data and Information Needs

The type of data and information required will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a description of the heat dissipation system, including type, location, size, and schedule of operation (from ESRP 3.4.1)

- for plants using spray cooling ponds, or mechanical draft or natural draft cooling towers, the length and duration of elevated plumes and drift predictions (from ESRPs 5.3.3.1 and 5.3.3.2)

- maps showing land use within the site and vicinity. Land-use categories should be consistent with those defined in USGS (1997) (from ESRP 2.2.1).

- tabulations of land areas devoted to major uses within the site vicinity. Land-use categories should be consistent with those defined in USGS (1997) (from ESRP 2.2.1).

- information on sensitivity of resident species to salts expected from effluents from cooling towers and spray ponds (from the environmental report [ER])

- location of roads and bridges within the site vicinity (from ESRP 2.2.1).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of land-use impacts at the site of the nuclear-power station and in its vicinity are based on the relevant requirements of the following:

- 10 CFR 51.71(d) with respect to analysis requirements to be included in draft environmental impact statements (EISs) prepared by NRC

- 10 CFR 51, Appendix A(7), with respect to discussion in EISs prepared by NRC of possible conflicts between alternatives and the objectives of applicable land-use plans.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no conflicts between the applicant's proposed facility and the objectives of Federal, State, regional, and local (and in the case of proposed location on a reservation, Native American tribal) land-use plans and the Federal sources shown in Table 4.1.1-1 (plus comparable State sources).

or

- If there are or are likely to be conflicts, the extent of the conflicts, the possibilities of resolving the conflicts, and the seriousness of the impact of the applicant's proposal on land-use plans and policies and the effectiveness of land-use control mechanisms for the area can be adequately evaluated and discussed in the EIS or other environmental document.

Technical Rationale

The technical rationale for evaluation of the applicant's description of impacts to the site and vicinity is discussed in the following paragraphs:

NRC's regulations implementing NEPA provide that NRC EISs are to include a section discussing the environmental consequences of alternatives (10 CFR 51, Appendix A[7]). The section is to

include a discussion of "possible conflicts between the alternatives and the objectives of Federal, State, regional, and local (and in the case of a reservation, Native American tribal) land-use plans, policies, and controls for the area concerned." In addition, the regulations provide that due consideration will be given in an EIS to compliance with applicable zoning and land-use regulations (10 CFR 51.71[d]).

The questions of (1) what constitutes a land-use plan or policy, and (2) how an agency should handle potential conflicts between a proposal and the objectives of land-use plans are addressed by the Council on Environmental Quality (CEQ) in Question 23 of CEQ (1981). With regard to what constitutes a land-use plan or policy, CEQ (1981) states on page 18033 that

> The term "land-use plans" includes all types of formally adopted documents for land-use planning, zoning, and related regulatory requirements. Local general plans are included, even though they are subject to future change. Proposed plans should also be addressed if they have been formally proposed by the appropriate government body in a written form and are being actively pursued by officials of the jurisdiction. Staged plans, which must go through phases of development ... should also be included even though they are incomplete.

With regard to how an agency should handle potential conflicts between a proposal and the objectives of land-use plans, CEQ (1981) states on page 18033 that

> The agency should first inquire of other agencies whether there are any potential conflicts. If there would be immediate conflicts, or if conflicts could arise in the future when the plans are finished ... the EIS must acknowledge and describe the extent of those conflicts. If there are any possibilities of resolving the conflicts, these should be explained as well. The EIS should also evaluate the seriousness of the impact of the proposal on the land-use plans and policies, and whether, or how much, the proposal will impair the effectiveness of land-use control mechanisms for the area. Comments from officials of the affected area should be solicited early and should be carefully acknowledged and answered in the EIS.

III. REVIEW PROCEDURES

Land-use impacts to the site and vicinity because of construction are covered in ESRP 4.1.1 and limited portions of land-use impacts on the vicinity are covered in ESRPs 4.1.3, 4.3.1, 4.4, 5.3.3.1, and 5.3.3.2. As a general rule, the land-use changes considered in the staff's environmental reviews of construction impacts (ESRP 4.0) are sufficient to cover most land-use impacts on the site and vicinity due to the physical presence of the plant. Such land-use changes on the site will not be altered during subsequent plant operation, and thus the above referenced analyses of these changes should suffice for plant operation. For example, where plant construction preempts the exploitation of mineral resources, the analysis of this impact as prepared by the reviewer for ESRP 4.1.1 should be used because the operational impact is only an extension in time of the construction impact. This ESRP should be limited to those direct restrictions on land use in the site vicinity resulting from plant operation.

When assessing the impacts of plant operation on land use in the vicinity, the reviewer should take the following steps:

(1) Using the results of the related reviews, assess the probable impacts of plant operation on crops or other vegetation or on transportation systems to establish if any would be severe enough to result in a change in land-use patterns in the site vicinity.

   (a) Realize that the impacts on land use resulting from plant operation are primarily those related to salt drift from cooling tower or spray pond operation and are thus limited in scope.

   (b) Explore all possibilities of "special case" land-use impacts (e.g., operational impacts to floodplain[a] land use and reallocation of irrigation water to plant cooling water), but specific instructions for such special cases are not provided in this ESRP.

(2) Using the predictions of drift and plume from the cooling system (ESRP 5.3.3.1), establish the areas in which there is potential for fogging, icing, or drift damage (ESRP 5.3.3.2) of sufficient magnitude to result in potential land-use changes.

   (a) Add the additional land area potentially changed to the area already committed by plant construction (ESRP 4.1.1).

   (b) Conduct an analysis as outlined in ESRP 4.1.1, preferably as a part of the analysis called for in ESRP 4.1.1.

(3) Plants with once-through cooling systems have no general impacts on land use because of plant operation; nevertheless, conduct a limited inquiry to reveal any site-specific or unusual impacts.

The evaluation of land-use impacts at the site or in the vicinity resulting from station operation should follow the procedures outlined in the "Review Procedures" of ESRP 4.1.1 for any additional land area potentially changed beyond that land area committed because of plant construction.

IV. EVALUATION FINDINGS

The review should be directed toward the following objectives: (1) public disclosure of major direct land-use consequences of the proposed project, (2) presentation of the basis of staff analysis of the project, and (3) presentation of staff conclusions, recommendations, and conditions regarding land use.

Because the review for this section is closely allied to the review for ESRP 4.1.1, the reviewer should recognize that some information may be included in ESRP 4.1.1. The reviewer should not repeat this

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(a) The term "floodplain" is defined in 10 CFR 72.3.

information in ESRP 5.1.1, but should instead refer to ESRP 4.1.1, including in this ESRP only the additional information that is specifically related to operational land-use impacts in the site vicinity.

Public disclosure may be accomplished by presenting a brief description of plant operation and a discussion of the resulting land-use changes. This section should be prepared as a summary that a nontechnical reader can understand. Extensive descriptive material should be incorporated by reference and should not be duplicated in the EIS.

The basis of the staff's analysis may be presented in a narrative summary by highlighting important aspects of the impacts resulting from land-use changes. The discussion should identify important effects and mitigating actions proposed by the applicant or the staff. Minor issues should receive minor treatment. Important issues should be discussed in detail.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(7), "Environmental Consequences and Mitigating Actions."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 72.3, "Licensing requirements for the independent storage of spent nuclear fuel and high-level remediation waste: definitions."

Council on Environmental Quality (CEQ). 1981. "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 *Federal Register* 18026-18037 (1981).

U.S. Geological Survey (USGS). 1997. "USGS Land Use and Land Cover Data," USGS Survey Earth Resources Observation Data Center, Sioux Falls, South Dakota.

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5.1.2 TRANSMISSION CORRIDORS AND OFFSITE AREAS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's assessment of direct impacts to land use resulting from operation and maintenance of the transmission corridors, access corridors, and offsite areas. The scope of the review directed by this plan should be limited to consideration of these corridors and areas in sufficient detail to form a basis for assessing the impacts of operation and maintenance. Where necessary, the reviewer should consider alternative designs or practices that would mitigate adverse environmental impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 2.2.2, 2.4.1, 2.6, 3.7, and 4.1.2. Obtain information about the following topics: land-use description of transmission corridors, access corridors, and other offsite areas; principal terrestrial ecological features of these areas; potential geologic environmental input; design characteristics of the proposed transmission system; and land-use impacts of transmission line construction.

- ESRP 5.10. Provide a list of the measures and controls to limit adverse land-use impacts that are to be recommended for consideration in the licensing process.

- ESRP 9.4.3. Provide a list of adverse land-use impacts that could be avoided or mitigated through alternative transmission system operational or maintenance procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable adverse land-use impacts that are predicted to occur as a result of transmission system operation.

- ESRP 10.3. Provide land-use information for the transmission corridors and offsite areas that is related to short-term uses and long-term productivity of the environment.

Data and Information Needs

The type 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 the potential impacts. The following data or information should be obtained:

- proposed routes for corridors that will be used for transmission lines from the plant site to an interconnecting point or points on the existing high voltage transmission systems (from ESRP 2.2.2)

- proposed routes of access corridors to serve the proposed station (from ESRP 2.2.2)

- identification of offsite areas by land use, size, and location (from ESRP 2.2.2)

- land-use restrictions, if any, contained in any easements (from ESRP 2.2.2)

- corridor lengths, widths, and areas (from ESRP 2.2.2)

- land use within the corridors using the categories defined in USGS (1997). Land-use information should be subdivided into corridor segments having predominantly similar land-use types (from ESRP 2.2.2).

- if specific corridors have not been established, and only bands are given, a description of land use within the band using the categories as defined in USGS (1997) (from ESRP 2.2.2)

- Federal, State, regional, local, and affected Native American tribal land-use plans (from ESRP 2.2.2)

- highways, railroads, and utility rights-of-way that will be crossed by transmission lines and access corridors (from ESRP 4.1.2)

- land-use impacts of construction (from ESRP 4.1.2)

- basic transmission system electrical and structural design parameters (from ESRP 3.7)

- a description of maintenance practices (e.g., vegetation control and access road maintenance), operational characteristics (e.g., transmission system noise, electrical interference effects, and access road traffic), and their associated land-use restrictions or changes (from the environmental report [ER]).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of land-use impacts at the site of transmission corridors and offsite areas are based on the relevant requirements of the following:

- 10 CFR 51.71(d) with respect to analysis requirements to be included in draft environmental impact statements (EISs) prepared by NRC

- 10 CFR 51, Appendix A(7), with respect to discussion in EISs prepared by NRC of possible conflicts between alternatives and the objectives of applicable land-use plans.

Regulatory positions and specific criteria necessary to meet regulations identified above are as follows:

- There are no conflicts between the applicant's proposed facility and the objectives of Federal, State, regional, and local (and in the case of proposed location on a reservation, Native American tribal) land-use plans and the Federal sources shown in Table 4.1.1-1 (plus comparable State sources)

or

- If there are or are likely to be conflicts, the extent of the conflicts, the possibilities of resolving the conflicts, and the seriousness of the impact of the applicant's proposal on land-use plans and policies and the effectiveness of land-use control mechanisms for the area can be adequately evaluated and discussed in the EIS or other environmental document.

Technical Rationale

The technical rationale for evaluation of the applicant's impacts resulting from land use of transmission corridors, access corridors, and offsite areas is discussed in the following paragraphs:

NRC's regulations implementing NEPA provide that NRC EISs are to include a section discussing the environmental consequences of alternatives (10 CFR Part 51, Appendix A[7]). The section is to include a discussion of "possible conflicts between the alternatives and the objectives of Federal, State, regional, and local (and in the case of a reservation, Native American tribal) land-use plans, policies and controls for the area concerned." In addition, the regulations provide that due consideration is to be given in an EIS to compliance with applicable zoning and land-use regulations (10 CFR 51.71[d]).

Guidance on (1) what constitutes a land-use plan or policy, and (2) how an agency should handle potential conflicts between a proposal and the objectives of land-use plans is provided by the Council

on Environmental Quality (CEQ) in Question 23 of "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations (CEQ 1981). With regard to what constitutes a land-use plan or policy, CEQ states on page 18033 that

> The term "land-use plans" includes all types of formally adopted documents for land-use planning, zoning and related regulatory requirements. Local general plans are included, even though they are subject to future change. Proposed plans should also be addressed if they have been formally proposed by the appropriate government body in a written form, and are being actively pursued by officials of the jurisdiction. Staged plans, which must go through phases of development ... should also be included even though they are incomplete.

With regard to how an agency should handle potential conflicts between a proposal and the objectives of land-use plans, CEQ (1981) states on page 18033 that

> The agency should first inquire of other agencies whether there are any potential conflicts. If there would be immediate conflicts, or if conflicts could arise in the future when the plans are finished ..., the EIS must acknowledge and describe the extent of those conflicts. If there are any possibilities of resolving the conflicts, these should be explained as well. The EIS should also evaluate the seriousness of the impact of the proposal on the land-use plans and policies, and whether, or how much, the proposal will impair the effectiveness of land-use control mechanisms for the area. Comments from officials of the affected area should be solicited early and should be carefully acknowledged and answered in the EIS.

III. REVIEW PROCEDURES

The analysis of the land-use impacts of operation of the transmission corridors, access corridors, and offsite areas is an extension of the analysis conducted under the review of ESRP 4.1.2. The same considerations outlined in the Review Procedures of ESRP 4.1.2 should apply. Additional considerations include land-use restrictions or changes that could occur because of maintenance practices, access-corridor use, noise, or electric or magnetic fields.

The reviewer should conduct the evaluation of land-use impacts in transmission corridors and other offsite areas resulting from station operation using the procedures outlined in ESRP 4.1.2.

IV. EVALUATION FINDINGS

The review should accomplish the following objectives: (1) public disclosure of major direct land-use consequences from operation of the transmission corridors and offsite areas, (2) presentation of the basis of the staff analysis of the project, and (3) presentation of staff conclusions and recommendations regarding land use.

Because the review for this section is closely allied to the review for ESRP 4.1.2, the reviewer should recognize that some information may be included in ESRP 4.1.2. The reviewer should not repeat the information in ESRP 5.1.2, but should refer to ESRP 4.1.2 instead, including in this ESRP only the additional information specifically related to operational land-use impacts.

Public disclosure may be accomplished by presenting a brief description of the land-use changes resulting from transmission system operation. This section should be prepared as a summary that a non-technical reader can understand. Extensive descriptive material may be incorporated by reference and need not be duplicated in the EIS.

The basis of the staff's analysis may be presented in a narrative summary by highlighting important aspects of impacts resulting from land-use changes. The discussion should include identification of important effects and mitigating actions proposed by the applicant or by the staff. Minor issues should receive minor treatment. Important issues should be discussed in detail.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(7), "Environmental Consequences and Mitigating Actions."

10 CFR 51.71, "Draft environmental impact statement—contents."

Council on Environmental Quality (CEQ). 1981. "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 *Federal Register* 18026-18037 (1981).

U.S. Geological Survey. (USGS). 1997. "USGS Land Use and Land Cover Data," USGS Survey Earth Resources Observation Data Center, Sioux Falls, South Dakota.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

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5.1.3 HISTORIC PROPERTIES

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's assessment of potential impacts of proposed project operation on historic properties in the site and vicinity, along transmission corridors, and at offsite areas. Historic properties include districts, sites, buildings, structures, or objects of historical, archaeological, architectural, or traditional cultural significance (U.S. Department of the Interior 1990a, 1990b). Historic properties that need to be considered during the project include those evaluated as being "significant," which are those properties that are either listed in or eligible for listing in the *National Register of Historic Places* (U.S. Department of the Interior 1977).

The scope of the review directed by this plan should include consideration of the impacts of operation on significant historic properties and the adequacy of proposed methods to mitigate any adverse impacts on these resources.

The review should be of sufficient detail to enable the reviewer to predict and assess potential impacts and to evaluate how these impacts should be treated in the licensing process. Where appropriate, the reviewer should consider alternative locations, designs, or operating procedures that would mitigate predicted adverse impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 4.1.3. Obtain input regarding land-use impacts from construction that could impact operations.

- ESRP 5.10. Provide a list of applicant commitments and staff evaluations of practices to limit adverse impacts of operation, including (1) actions required to avoid or mitigate adverse impacts, and (2) procedures for protection of significant historic properties.

- ESRPs 9.3 and 9.4. If the reviewer concludes that a proposed operation will result in adverse impacts to historic and cultural resources that should be avoided, then obtain from the reviewers for ESRPs 9.3 and 9.4 alternative plant designs, locations, or operational activities that would avoid the impacts.

- ESRP 10.1. Provide a list of the unavoidable adverse impacts that are predicted to occur as a result of proposed project operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a description of historic and archaeological resources within the site boundary, transmission or access corridors, or offsite areas (from ESRP 2.5.3)

- a description of historic or archaeological resources that are within 16 km (10 mi) of the proposed site or within 2 km (1.2 mi) of proposed transmission corridors, access corridors, or offsite areas (from ESRP 2.5.3)

- the State Historic Preservation Officer's (SHPO's) comments on the impact of the proposed project on significant historic properties (from ESRP 4.1.3)

- State laws and plans for historic preservation (from ESRP 4.1.3).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of historic properties that could be impacted by proposed operation are based on the relevant requirements of the following regulations:

- 36 CFR 800 defines the process by which a Federal agency meets its requirements under Section 106 of the National Historical Preservation Act (NHPA) to ensure that agency assisted or agency licensed undertakings acknowledge the effects of the undertakings on historic properties that are eligible for listing in the *National Register of Historic Places*. Compliance will be necessary for any new construction or ground disturbing modifications during the operational phase.

Regulatory positions and specific criteria to meet the regulations identified above are as follows:

- Section 110 of the NHPA, which deals with agency responsibilities for ensuring that historic preservation is fully integrated into ongoing programs and missions of Federal agencies. The NRC is responsible for ensuring compliance with Section 110 of the NHPA during operation of the plant.

- Nuclear Reactor Regulation (NRR) Office Letter No. 906, Revision 1 (NRC 1996), which includes guidance for complying with the requirements contained in the NHPA pertaining to protection and preservation of significant historic properties during operation of the plant. NRR Office Letter No. 906 is revised periodically. Obtain a copy of the latest revision for current guidance.

Technical Rationale

The technical rationale for evaluation of the applicant's potential impacts to historic properties is discussed in the following paragraphs:

Because of NEPA and Section 106 of NHPA, the NRC's actions are required to fall under 36 CFR 800, which provides regulatory guidance for protecting historic properties from potential adverse impacts resulting from Federal agency undertakings.

Although compliance with Section 106 of NHPA may be necessary for new actions at an existing project during operation, the primary Federal agency responsibility for protection of historic properties during the operational phase falls under Section 110 of the same act (U.S. Department of the Interior and Advisory Council on Historic Preservation 1989).

III. REVIEW PROCEDURES

The reviewer's analysis and evaluation of operational impact on historic and archaeological resources should be based on the concurrent review of construction impacts (ESRP 4.1.3). Only the impacts of operation that differ from those resulting from construction need be assessed. In this respect, a temporal extension of an impact from the construction phase through the operational life of the project is not a different impact. Where the reviewer determines that the impacts of operation on cultural and historic resources have been adequately considered by the review directed by ESRP 4.1.3, no further review should be required. If the reviewer determines that there will be an impact of operation that would not have been considered by the reviewer for ESRP 4.1.3 (e.g., the impact of the visual plume from a cooling tower), the reviewer should assess that operational impact as an extension of the review directed by ESRP 4.1.3.

IV. EVALUATION FINDINGS

The ESRP review should be designed to accomplish the following objectives: (1) public disclosure of impacts resulting from operation, (2) presentation of the basis for the staff analysis, and (3) presentation

of staff conclusions, regarding impacts of the reviewed operational activities on historic properties. The following information should be included in the environmental impact statement (EIS):

Where there will be no impacts that are unique to plant operation, the following wording should be used:

> The staff determined that the impacts of operation on historic properties will be no more than temporal extensions of the impacts of construction assessed in ESRP 4.1.3. Consequently, no further discussion is required.

Where the impacts of operation differ from those described in ESRP 4.1.3, the reviewer should include a description of these impacts on those properties that are listed in or eligible for inclusion in the *National Register*. The reviewer should discuss the steps that led to a determination of whether the effect is adverse.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

36 CFR 800, "Protection of Historic Properties."

U.S. Department of the Interior. 1977. "Guidelines for Local Surveys: A Basis for Preservation Planning," *National Register of Historic Places*, Bulletin 24 (revised 1985).

U.S. Department of the Interior. 1990a. "How to Apply the National Register Criteria for Evaluation," *National Register of Historic Places*, Bulletin No. 15 (revised 1991).

U.S. Department of the Interior. 1990b. "Guidelines for Evaluating and Documenting Traditional Cultural Properties," *National Register of Historic Places*, Bulletin No. 38.

U.S. Department of the Interior and Advisory Council on Historic Preservation. 1989. "The Section 110 Guidelines: Annotated Guidelines for Federal Agency Responsibilities under Section 110 of the National Historic Preservation Act," Washington, D.C.

U.S. Nuclear Regulatory Commission, NRR Office Letter No., 906, Rev. 1. 1996. "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues," Office of Nuclear Reactor Regulation, Washington, D.C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.2 WATER-RELATED IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the hydrological alterations, plant water supply, and water-use impacts of station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.2.1 and 5.2.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluation of the applicant's water-related impacts is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.2.1 and 5.2.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70 "Draft environmental impact statement—general."

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ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.2.1 HYDROLOGIC ALTERATIONS AND PLANT WATER SUPPLY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification, analysis, and description of hydrologic alterations resulting from plant operation and the staff's analysis of the adequacy of the water sources proposed to supply plant water needs.

The scope of the review directed by this plan should include (1) the identification and description of proposed operational activities that could result in hydrologic alterations, (2) the identification, description, and analysis of the resulting hydrologic alterations and the effects of these alterations on other water users, (3) the analysis of proposed practices to minimize hydrologic alterations having adverse impacts, (4) the analysis and comparison of plant water needs and the availability of water supplies to meet those needs, and (5) conclusions with respect to the adequacy of water supplies to meet plant water needs.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain descriptions of the hydrology (e.g., physical characteristics of the surface-water bodies and groundwater aquifers) of the region surrounding the proposed plant site.
- ESRP 2.3.2. Obtain descriptions of the regional water uses (and users) for the area surrounding the proposed plant site.

- ESRP 3.3. Obtain input regarding expected water use by the proposed plant. This includes water sources, points of water return, and variations in water use by season and plant operational mode.

- ESRP 3.4. Obtain input regarding the cooling system for the proposed plant.

- ESRP 3.6. Obtain descriptions of the waste systems for nonradioactive waste discharged from the proposed plant.

- ESRP 5.2.2. Provide a list of operational activities resulting in hydrologic alterations, and the resulting effects of these alterations to other water users. Additional information should be provided to other ESRP Chapter 5.0 reviewers when the reviewer for ESRP 5.2.2 requests that such input be made.

- ESRPs 5.3.1.1 and 5.3.2.1. Provide descriptions of operational hydrologic alterations that will support the descriptions of intake system hydrodynamics and discharge thermal plumes in ESRPs 5.3.1.1 and 5.3.2.1.

- ESRPs 5.3.1.2 and 5.3.2.2. Provide descriptions of operational hydrologic alterations that may affect aquatic ecosystems.

- ESRP 5.10. Provide a list of identified measures and controls to limit or minimize hydrologic alterations and, when necessary, identified operational practices and procedures to match plant-water needs to available water supplies.

- ESRPs 6.1 and 6.3. Obtain a list of identified preoperational baseline monitoring programs.

- ESRP 9.4. Provide assistance in identifying and evaluating alternative plant design and operational practices and procedures that would minimize or avoid operational hydrologic alterations that result in adverse environmental impacts.

- Interface with Environmental Project Manager (EPM). Obtain input from the EPM on any operation activity likely to result in hydrologic alterations to the floodplain.

Data and Information Needs

The type of data and information needed will be affected by site-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- descriptions of the physical characteristics of the surface-water bodies and groundwater aquifers (from ESRP 2.3.1)

- quantitative descriptions of proposed water sources, including groundwater sustained yield, 7-day once-in-10-years low flow, flows (including reverse and regulated) and yields during the drought of record, and low lake levels; estimates of frequency and duration of water-supply shortages (from ESRP 2.3.1 and the environmental report [ER])

- withdrawals and returns of surface water and groundwater used for plant operation, including rates and sources of water. This should include the different operational modes of the plant (e.g., maximum water intake and consumption, minimum water availability, average plant water use by month, and during shutdown). The information should also include plant effluent quantity and physical characteristics as a function of the different operational modes (from ESRP 3.3.1 and the ER).

- a quantitative description of present and known future surface-water uses (diversions, consumptions, and returns) that are within the hydrological system in which the plant is located and that may affect plant water availability or be affected by plant water use. The following should be included for each use (from ESRP 2.3.2 and the ER):

  - locations of diversions and returns with respect to the plant intake system
  - identification of water bodies
  - average monthly withdrawal and consumption rate.

- a quantitative description of present and known future groundwater withdrawals on the site and for distances great enough to cover aquifers that may affect plant water availability or be affected by plant water use. The following should be included for each use (from ESRP 2.3.2 and the ER):

  - location, depth, and elevation of wells (total and cased) and water levels with respect to the plant
  - identification of aquifers
  - average monthly withdrawal rates.

- operational activities expected to result in hydrologic alterations within the site and vicinity, along transmission corridors, or at offsite areas. These activities can include dredging operations, operations affecting water levels, and dewatering activities (from the ER).

- identification and description of the hydrological alterations resulting from the identified operational activities. These can include changes in the flood handling capability of the floodplain, flow and circulation patterns, erosion subsidence, water availability, and sediment transport (from the ER).[a]

- identification and locations of surface-water and groundwater users (including aquatic ecosystems) and water-use areas that could be affected by hydrologic alterations resulting from plant operation (from ESRP 2.3.2, the ER and the site visit)

(a) See ESRP 2.3.1 for a definition of the floodplain.

- a summary of statutory and other legal restrictions relating to plant water use and water consumption (from ESRP 2.3.2 and the ER)

- descriptions of proposed means to ensure compliance with standards and regulations affecting plant water use and water consumption, and proposed practices and measures to limit or minimize operational hydrologic alterations (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the hydrologic alterations at the proposed plant sites are based on the relevant requirements of the following regulations:

- 33 CFR 322 with respect to definition of activities requiring permits

- 33 CFR 330, Appendix A, with respect to conditions, limitations, and restrictions on construction activities

- 40 CFR 6, Appendix A, with respect to procedures on floodplain and wetlands protection

- 40 CFR 122 with respect to the National Pollutant Discharge Elimination System (NPDES) permit conditions for discharges, including storm water discharges

- 40 CFR 149 with respect to possible supplemental restrictions on waste disposal and water use in or above a sole source aquifer

- 40 CFR 227 with respect to criteria for evaluating environmental impacts

- Federal, State, regional, local, and Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Compliance with environmental quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will establish its own impact determination.

- Because water quality and water supply are interdependent, changes in water quality must be considered simultaneously with changes in water supply. In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the States' role in regulating water rights.

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the format and content of ERs, including hydrology, water-use, and water-quality issues.

Technical Rationale

The technical rationale for evaluating the applicant's hydrologic alternations and plant water supply is discussed in the following paragraphs:

A detailed and thorough description of the hydrologic impacts occurring during plant operation is essential for the evaluation of potential impacts to the environment that may result from plant operation.

Water quality and water supply are interdependent. Changes in water quality must be considered simultaneously with possible changes in water supply.

III. REVIEW PROCEDURES

This section of the environmental impact statement (EIS) should be planned to accomplish the following objectives: (1) public disclosure of the hydrologic alterations resulting from plant operation and the comparison of plant water needs with water availability, (2) a discussion of the effects of these alterations and water supply/need comparisons, and (3) presentation of staff conclusions regarding the adequacy of plant-water supply to meet plant-water needs.

The reviewer's analysis of hydrologic alterations and water supply/water consumption comparison should be linked to the environmental descriptions provided by the environmental reviews for ESRPs 2.3 and 3.3 to ensure that the environmental factors most likely to be affected by operational hydrologic alterations and plant water consumption are described in sufficient detail to permit subsequent assessment of any potential impacts. The reviewer should coordinate the analysis of hydrologic alterations with the analysis prepared by the reviewer for ESRP 4.2.1 because the analyses for many of the hydrologic alterations resulting from plant construction will be sufficient to cover subsequent (period of plant operation) alterations due to the physical presence of the plant. Where these alterations will not be further changed by plant operation, the analysis prepared by the reviewer for Section 4.2.1 should suffice for plant operation. This environmental review should be limited to consideration of hydrologic parameters directly associated with plant operation.

The reviewer's identification of plant operational activities that could result in hydrologic alterations will require knowledge of the site and vicinity physiography, hydrology, and water uses. In addition, the reviewer should be familiar with Federal, State, regional, local, and Native American tribal regulations with respect to hydrology and water use.

When evaluating hydrologic alterations resulting from plant operation and the adequacy of the water sources proposed to supply plant water needs, the reviewer should take the following steps:

(1) Consider appropriate plant operating conditions (including periods of maximum plant water use, minimum water availability, average plant operation by month and during shutdown) and hydrologic variations affecting water use.

(2) Determine if all known future water uses (including aquatic ecosystems) have been considered.

(3) Estimate the effects of operational hydrologic alterations and restrictions on water availability on these users.

(4) Identify and analyze any measures proposed by the applicant to minimize or limit these alterations and restrictions.

(5) When analyzing water availability, coordinate this review with the reviewer for ESRP 3.3.1.

(6) When analyzing hydrologic alterations, coordinate this review with the reviewer for ESRP 4.2.1 to ensure that the reviewer is aware of the scope and extent of these related reviews and to avoid any duplication of effort.

(7) In consultation with the reviewer for ESRP 2.3.1, establish the physical availability of the proposed water sources, including consideration of the drought of record for the region and the 7-day once-in-10-years low flow.

(8) In consultation with the reviewer for ESRP 2.3.2, identify the other water uses, rights, and restrictions of the surface waters and groundwaters, including existing station water uses (e.g., an operating steam electric plant).

(9) In consultation with the reviewer for ESRP 3.3.1, determine plant needs for the following plant operating conditions: maximum water consumption, minimum water availability, average operation by month, and plant shutdown.

(10) Establish by comparison the adequacy of the water supply to accommodate anticipated plant operating modes.

(11) Analyze all operational activities that can alter the quantities of water physically available in nearby hydrologic systems and determine the alterations.

- Consider all water to be used during operation, under various plant operating (ESRP 3.3.1) and hydrologic (ESRP 2.3.1) conditions.

- Consider all water diversions that change the quantities of water in various parts of water systems (e.g., permanent dewatering) and water rights or allocations obtained for the plant.

- Determine the physical effects (e.g., altered well yields, water levels relative to intake pipes) likely to affect other water users and aquatic ecosystems for those hydrologic systems in which alterations in water quantities have been identified.

(12) Analyze the operational activities that can alter hydrologic geometries, flow and circulation patterns, and mixing processes and determine the alterations. Hydrologic alterations due to the intake or discharge system are covered in ESRPs 5.3.1.1 and 5.3.2.1.

- Consider other hydrologic alterations (e.g., maintenance dredging, permanent dewatering) with the potential for impacts to water users.

- Report any operational activity that will result in hydrologic alterations to the floodplain to the EPM and to the reviewer for ESRP 5.2.2.

- Analyze and evaluate such alterations in accordance with the instructions provided the reviewer for ESRP 4.2.1.

(13) Analyze the operational activities that can alter erosional, depositional, and sediment transport characteristics and determine the alterations. (Note that alterations resulting from intake or discharge system operation are addressed by the reviewers for ESRPs 5.3.1.1 and 5.3.2.1).

- Consider operational activities in relation to the natural processes that would occur in the absence of plant operation.

- For those areas in which alterations in the natural erosional, depositional, and sediment transport characteristics have been identified, determine the physical effects (e.g., beach erosion, increased turbidity) likely to affect other water users.

(14) Ensure that those operational activities resulting in hydrologic alterations have been identified, and seek confirmation that those alterations resulting in environmental impacts have been described in sufficient detail to allow for the subsequent analysis and assessment of these impacts.

(15) Evaluate the adequacy of plant water supplies with respect to plant water needs, using the following evaluation procedures:

- Determine if the identified alterations in water quantity in the various operationally affected hydrologic systems are compatible with existing and known future water rights and allocations.

- Describe the physical effects of identified alterations in the quantity of water available to other consumptive water users.

- Describe the physical effects of altered hydrologic geometry, flow, and circulation patterns in relation to non-consumptive water users. When proposed operational activities involving hydrologic alterations to the floodplain are identified, complete the evaluation of these alterations in accordance with the evaluation instructions of Section 4.2.1.

- Describe the physical effects of altered erosional, depositional, and sediment characteristics in relation to other water users, to property and (for those effects not addressed by the reviewers of ESRPs 5.3.1.1 and 5.3.2.1) to aquatic biota.

- Determine if the sources of water proposed to supply plant-water needs will be adequate for these needs, taking into account seasonable variations in water supply and the variations in water needs as a function of operating conditions. If the sources are determined to be inadequate under some conditions, describe the conditions, including seasonal/plant operating-mode factors, the estimated time duration of the inadequacy, and the predicted effect on plant operation.

IV. EVALUATION FINDINGS

The following information should be included in the EIS:

- a description of plant operational activities that will result in hydrologic alterations, and a description of these alterations and their effects for each affected water body

- the quantities and rates of water diverted, consumed, and discharged during plant operation. Sources of water and points of return should be identified. Variations (seasonal, plant operational modes) should be discussed.

- conclusions with respect to the adequacy of the proposed water sources to meet plant requirements, and effects on plant operation when the proposed water sources are inadequate to meet all plant-water needs

- conclusions with respect to the compatibility of proposed water diversions with existing and known future water rights and allocations

- recommendations for operational practices and procedures to minimize or limit operational hydrologic alterations having adverse impacts, or for alternative practices and procedures that could avoid these alterations

- identification and evaluation of operational practices and procedures that could avoid any incompatibilities between plant water needs and plant water supply.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

33 CFR 330, Appendix A, "Nationwide Permit and Conditions."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 149, "Sole Source Aquifers."

40 CFR 227, "Criteria for the Evaluation of Permit Applications for Ocean Dumping of Material."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1307; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.2.2 WATER-USE IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and assessment of predicted impacts of plant operation on water use.

The scope of the review directed by this plan should include (1) analysis of hydrologic alterations that could have impacts on water use, including water availability, (2) analysis of water-quality changes that could affect water use, (3) analysis and evaluation of impacts resulting from these alterations and changes, (4) analysis and evaluation of proposed practices to minimize or avoid these impacts, and (5) evaluation of compliance with Federal, State, regional, local, and affected Native American tribal regulations applicable to water use and water quality. Hydrologic alterations and water-quality changes should be considered as they may affect both surface-water and groundwater uses, including domestic, municipal, agriculture, industrial, mining, recreation, navigation, and hydroelectric power.

The review should be in sufficient detail to predict and assess potential impacts and to recommend how these impacts should be treated in the licensing process. Where necessary, the reviewer should identify and evaluate alternative designs, practices, or procedures that would mitigate or avoid predicted adverse impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain descriptions of the hydrology of the region surrounding the proposed plant site.

- ESRP 2.3.2. Obtain descriptions of the regional water uses (e.g., the location and nature of water users and water-use areas) for the area surrounding the proposed plant site.

- ESRP 2.3.3. Obtain descriptions of the baseline water quality of the water sources/bodies for the area surrounding the proposed plant site.

- ESRPs 3.3.1 and 3.3.2. Obtain input regarding expected water use by the proposed plant.

- ESRPs 3.4.1 and 3.4.2. Obtain descriptions of the cooling system of the proposed plant.

- ESRPs 3.6.1 through 3.6.3. Obtain descriptions of the nonradioactive waste systems for the proposed plant. Information regarding the quantity and concentration of waste streams (for chemicals or biocides, sanitary system wastes, and other nonradioactive wastes) should be obtained.

- ESRP 5.2.1. Obtain descriptions of the plant operational activities that could result in hydrologic alterations, the potential hydrologic alterations themselves, and the comparison of plant water needs and the availability of water supplies to meet those needs.

- ESRPs 5.3.1 through 5.3.3. Obtain input regarding the impacts of the proposed plant cooling system on aquatic systems. For the intake system, obtain information regarding the intake hydrodynamics and the physical impacts caused by the flow field induced by the intake. For the discharge system, obtain information regarding the impacts of the plant's thermal discharges on the receiving water bodies.

- ESRPs 5.5.1 and 5.5.2. Obtain input regarding the impacts of the nonradioactive waste systems (chemical and biocides, sanitary systems, other) for the proposed plant.

- ESRP 5.10. Provide a list of applicant commitments and staff recommendations for measures and controls to limit adverse water-use impacts.

- ESRP 6.3. Obtain a list of identified and evaluated preoperational baseline monitoring programs that will be needed to assess operational impacts to water use.

- ESRPs 9.3 and 9.4. Provide a list of adverse environmental impacts affecting water use that could be mitigated or avoided through alternative project designs or operational procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a list of the unavoidable adverse water-use impacts that are predicted to occur as a result of plant operation.

- ESRP 10.2. Provide a brief summary of the irreversible and irretrievable commitments of hydrological and water-use resources that are predicted to occur as a result of plant operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- descriptions of the site and vicinity water bodies and groundwater aquifers (from ESRP 2.3.1)
- descriptions of hydrologic alterations and their related operational activities (from ESRP 5.2.1)
- the physical effects of hydrologic alterations (from ESRP 5.2.1)
- a quantitative description of present and known future surface-water uses, including any station water uses not associated with the proposed project, that are within the hydrological system in which the plant is located and that may be adversely affected by the plant. The following should be included for each use (from the environmental report [ER] and ESRP 2.3.2):
  - identification of the water body
  - locations of diversions and returns with respect to the plant. Diversions located between the plant discharge and the region of complete dilution should be further characterized by location with respect to the water body.
  - average monthly withdrawal and consumption rate for each division by use category (e.g., domestic, municipal, agriculture).
- a quantitative description of present and known future groundwater withdrawals on the site and for distances great enough to cover aquifers that may be adversely affected by the plant. The following should be included for each use (from the ER and ESRP 2.3.2):
  - withdrawal location
  - depth and elevation of wells (total and cased depth) and water levels
  - identification of aquifers
  - average monthly withdrawal rates by use category.
- comparisons of water quantity available to other water users with existing and known future water rights and allocations (from ESRP 5.2.1)

- a quantitative and qualitative description of recreational, navigational, and other nonconsumptive known future water uses. For a 10-km (6-mi) radius, this should include the following (from ESRP 2.3.2):

  - identification of water bodies and location with respect to the plant
  - kind and location of activity on the water body
  - use rate with time variation.

- identification of water bodies receiving plant effluents and the expected average and maximum flow rates and composition of these effluents (from the ER)

- predicted impacts to water users or water-use categories described in the "Data and Information" section of this ESRP (from the ER)

- baseline water-quality data for surface-water and groundwater sources used for and impacted by plant operation (from ESRP 2.3.3)

- descriptions of any proposed practices and measures to control or limit operational water-use impacts (from the ER)

- summary of statutory and other legal restrictions relating to water use or specific water-body restrictions on water use imposed by Federal, State, regional, local, or affected Native American tribal regulations (from the ER and ESRP 2.3.2)

- Federal, State, regional, local, and affected Native American tribal standards and regulations applicable to water quality and water use (from consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- descriptions of proposed means to ensure operational compliance with water-quality and water-use standards and regulations (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the water-use impacts at the proposed plant sites are based on the relevant requirements of the following:

- 33 CFR 322 with respect to definition of activities requiring permits

- 40 CFR 6, Appendix A, with respect to procedures on floodplain and wetlands protection

- 40 CFR 122 with respect to permit conditions for discharges, including stormwater discharges

- 40 CFR 149 with respect to possible supplemental restrictions on waste disposal and water use in or above a sole source aquifer

- Federal, State, regional, local, and affected Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Compliance with environmental quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will establish its own impact determination.

- In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the States' role in regulating water rights. As a result of this ruling, the States may regulate the quantity of water as a part of the definition of water quality.

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the format and content of ERs including hydrology, water-use, and water-quality issues.

Technical Rationale

The technical rationale for evaluating the applicant's potential water-use impacts is discussed in the following paragraph:

> A detailed and thorough description of the water use during plant operations is essential for the evaluation of potential impacts to the environment that may result from plant construction or operation. Because water quality and water supply are interdependent, changes in water quality must be considered simultaneously with possible changes in water supply.

III. REVIEW PROCEDURES

The review conducted with this plan should be directed toward accomplishing the following objectives: (1) public disclosure of major direct water-use consequences of plant operation, (2) presentation of the

basis for the staff analysis, and (3) presentation of staff evaluations, conclusions, and conditions regarding water use. The reviewer should coordinate this input with the reviewer of ESRP 5.2.1 to avoid duplication.

The reviewer's analysis of operational impacts on water use should be linked to the environmental descriptions provided by ESRPs 2.3 and 3.3 to ensure that the environmental factors most likely to be impacted by the proposed plant operation are described in sufficient detail to permit assessment of the predicted impacts.

The reviewer should coordinate this analysis with the reviewer for ESRP 2.3.3 and with the reviewers for ESRPs 5.3.2.2 and 5.5 to identify and analyze those water-quality changes affecting water use. The reviewer should also coordinate this review with the analysis of construction impacts described in ESRP 4.2.2 because the analyses for many of the water-use changes considered in the staff's environmental review of construction impacts will be sufficient to cover subsequent (period of plant operation) impacts due to the physical presence of the plant. Where these changes will not be further altered by plant operation, the plant construction impact analyses (environmental standard) will suffice for plant operation. This environmental review should be limited to consideration of the impacts on water use that are direct results of plant operation. Unless the reviewers for ESRP 2.3 indicate a potential for operational water-use impacts along transmission corridors or at offsite areas, this review may be limited to potential site and vicinity water-use impacts.

Site Visit

During the site visit, the reviewer should

- Observe the general pattern of water use at the site and vicinity and at those identified offsite and transmission corridor areas where operational activities could be expected to impact water use.
- Identify those water users and water-use areas that should be considered.
- Consult with appropriate nearby Federal, State, regional, local, and affected Native American tribal agencies for further identification of water users, water-use areas, or water-quality considerations that should be analyzed.
- Consider appropriate plant operating conditions (including periods of maximum plant water use, minimum water availability, average plant operation by month and shutdown water requirements) and hydrologic variations in analyzing potential water-use impacts.

Areas of Impact

The reviewer should evaluate the impacts of water use on water availability, hydrologic alterations, and water quality.

Water Availability

When addressing water availability, the reviewer should take the following steps:

(1) Ensure that the water users and water-use areas potentially impacted by alterations in water quantity and availability as a result of plant operation have been identified and that any impacts of reduced water quantity and availability have been identified and assessed.

- Make this assessment through consultation with the reviewers for ESRPs 5.1 and 5.8 and, where necessary, with the assistance of nearby Federal, State, regional, local, and affected Native American tribal agencies.

- When adverse impacts have been identified, consult with the reviewer for ESRP 5.2.1 for assistance in identifying design or procedure modifications that could mitigate the impact.

(2) Ensure that the possibility for conflicts between proposed plant water use and existing and known future water rights and allocations has been considered and that the probable nature and extent of these conflicts has been described.

(3) Ensure that any transfer of water rights (e.g., from irrigation use to plant consumptive use) has been described and that the impacts associated with such transfers have been identified and assessed.

Hydrologic Alterations

When addressing hydrologic alterations, the reviewer should take the following steps:

(1) Ensure that the hydrologic alterations identified by the reviewers for ESRPs 5.2.1, 5.3.1.1, and 5.3.2.1 have been analyzed with respect to their potential impacts to water users or water-use areas.

- Compare the effects of these alterations (e.g., turbidity, erosion, sedimentation) with pre-operational conditions to assess the extent of the impact.

- Evaluate impacts for individual water users and for water-use areas.

- Consult with the reviewer for ESRP 5.5 for assistance in this evaluation and to coordinate the overall evaluation of operational impacts due to hydrologic alterations.

- When necessary, consult with Federal, State, regional, local, and affected Native American tribal agencies for assistance.

- Seek means to mitigate or avoid any identified adverse impacts.

(2) Seek confirmation that any operational activities affecting a floodplain or wetland have been described by the reviewer for ESRP 5.2.1.

- Consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies to determine the extent to which such activities will conform with applicable floodplain and wetlands standards.

- Consult with the reviewer for ESRP 5.2.1 and the reviewers for ESRP 9.4 to analyze alternatives to any such activity affecting a floodplain or wetland.

(3) Ensure that operational activities that will alter or restrict surface oriented water uses (e.g., commercial and recreational fishing or navigation) have been identified and that their effects on water users have been described.

- Ensure that structurally related impacts on surface oriented water use (e.g., breakwaters or jetties having impacts to navigation) have been addressed by the reviewer for ESRP 4.2.2.

- Identify and assess any operational impacts (e.g., altered current velocities associated with cooling water discharges) that would increase or modify these structurally related impacts.

- Seek confirmation that identified hydrologic alterations resulting from plant operation comply with applicable Federal, State, regional, local, and affected Native American tribal standards and regulations.

- Consider site- and region-specific water-use type, frequency, and magnitude because many of the impacts resulting from hydrologic alterations do not permit development of specific criteria for determining adversity.

- When potential adverse impacts are predicted, identify alternative designs or operating procedures that could mitigate the impacts.

Water Quality

When addressing water quality, the reviewer should take the following steps:

(1) Ensure that hydrologic alterations and operational activities affecting water quality have been identified and their effects on water users or water-use areas described.

(2) Consult with the reviewers for ESRPs 2.3.2 and 2.3.3 to ensure that potentially affected water users have been identified and that baseline water-quality data for the affected users and water bodies are available.

(3) Evaluate impacts on the basis of altered water quality, taking into account the nature of the impact, the time duration or time periods when the impact will be experienced, the number of water users or extent of water-use areas affected, and the water-quality requirements of the affected users or areas.

- Consult with the reviewer for ESRPs 5.3.2.2 and 5.5 to coordinate this evaluation and to avoid duplication of effort with other ESRP Chapter 5.0 reviewers.
- When necessary, consult with Federal, State, regional, local, and affected Native American tribal agencies for assistance in evaluating the identified impacts.
- When adverse impacts have been identified, seek alternative operational procedures to avoid the impact.

(4) Consult with the reviewers for ESRP 3.6 to determine the flow rates and chemical composition of plant effluents. Consider potential impacts on water users or water-use areas in terms of the intended usage (e.g., chemical contaminants affecting a municipal water supply, suspended solids affecting industrial use, turbidity affecting recreational use).

(5) Determine if operational activities affecting surface-water and groundwater quality will comply with Federal, State, regional, local, and affected Native American tribal agency water-quality standards for effluents and receiving water bodies. This evaluation should be made in consultation with the reviewer for ESRP 5.5 to avoid any duplication of effort in the evaluation of water-quality impacts.

IV. EVALUATION FINDINGS

The following information should be included in the environmental impact statement (EIS):

- a description of plant operational activities that will cause adverse water-use impacts and a description of these impacts for principal water users and water-use areas
- a comparison of predicted effluent and receiving water quality with applicable effluent limitations and water-quality standards, and conclusions with respect to proposed project compliance with these standards
- the physical impacts of consumptive plant water use on other water users
- the compatibility of proposed plant water use with existing and known water rights and allocations, and the impacts associated with any transfer of water rights for plant water use
- adverse impacts to surface-oriented water users resulting from plant operation
- identification and evaluation of plant design and operating procedures to mitigate potential adverse water-use impacts, or of alternative designs or procedures that could be used to avoid these impacts.

Evaluation of each identified impact will result in one of the following determinations:

- *The impact is minor, and mitigation is not required.*

- *The impact is adverse, but can be mitigated by specific design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the Environmental Project Manager and the appropriate ESRP 9.4 reviewer for verification that any proposed modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications and measures and controls to limit the corresponding impact. These lists should be provided to the reviewer for ESRP 5.10.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the appropriate ESRP 9.4 reviewers that an analysis and evaluation of alternative designs or procedures is required. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should give this information to the reviewer for ESRP 10.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 149, "Sole Source Aquifers."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1037; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

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5.3 COOLING SYSTEM IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the cooling system impacts of station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.3.1 through 5.3.3.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's potential cooling system impacts is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.3.1 through 5.3.3.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.3.1 INTAKE SYSTEM

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the impacts of the intake system during station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.3.1.1 and 5.3.1.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's intake system impacts is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.3.1.1 and 5.3.1.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.3.1.1 HYDRODYNAMIC DESCRIPTIONS AND PHYSICAL IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of intake hydrodynamics and analysis and assessment of predicted physical impacts caused by the flow field induced by the intake system.

The scope of the review directed by this plan should include consideration of the spatial and temporal distribution of the surface-water body flow field and the physical effects of the flow field induced by intake system operation. The review should be in sufficient detail to describe intake hydrodynamics to the extent necessary for subsequent assessment of predicted intake system impacts to aquatic biota. In addition, the reviewer should assess potential intake system physical impacts (e.g., bottom scouring, induced turbidity, silt buildup) and evaluate how these impacts should be treated in the licensing process. When necessary, the reviewer should identify and evaluate alternative designs, practices, or procedures that would mitigate or avoid predicted adverse impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain descriptions of the hydrology of the region surrounding the proposed plant site (specifically, the hydrology of the surface water bodies that will be affected by the intake system).

- ESRP 2.4.2. Obtain descriptions of the baseline aquatic ecology for the surface water bodies in the area surrounding the proposed plant site that will be affected by the cooling system intake system.

- ESRP 3.1. Obtain descriptions of the layout of the proposed plant (specifically, the layout of the main water bodies, including locations of all intakes and discharges).

- ESRP 3.3.1. Obtain descriptions of the expected water use of the proposed plant.

- ESRPs 3.4.1 and 3.4.2. Obtain descriptions of the cooling system of the proposed plant.

- ESRP 5.2.2. Provide input related to potential water-use restrictions caused by operation of the intake system.

- ESRP 5.3.1.2. Obtain input regarding the potential for impacts of the induced hydrodynamic flow field to aquatic biota (which will be used to determine the appropriate extent of the hydrodynamic description required for the environmental impact statement [EIS]).

- ESRP 5.3.2.1. Obtain descriptions of the physical impacts to surface-water bodies caused by the discharge system of the proposed plant (if the same water bodies are used for intake to the cooling system).

- ESRPs 5.3.1.2 and 5.3.2.1. Provide a description of the intake system hydrodynamic flow field.

- ESRP 5.8.1. Provide a summary of the physical impacts related to the presence and operation of the intake system.

- ESRP 5.10. Provide a list of measures and controls to limit adverse impacts that have been identified and evaluated for consideration in the licensing process.

- ESRPs 6.3 and 6.6. Provide input regarding the need for and possible limitations on any monitoring activities as a result of the presence or operation of the cooling intake system.

- ESRP 9.4. Provide a list of adverse physical impacts that could be mitigated or avoided through alternative intake system designs or operational procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable adverse physical impacts that are predicted to occur as a result of intake system operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- bathymetry and sediment characteristics in the vicinity of the intake structure(s) (from ESRP 2.3.1)
- maps depicting station layout with respect to the water body, including locations of all intakes and discharges (from ESRPs 3.1 and 3.4.2)
- intake flow rates and velocities as a function of plant operating conditions (from ESRP 3.4.2)
- detailed drawings of the intake structure(s), including the relationship of the structure to the water surface (normal and minimum levels) (from ESRP 3.4.2)
- ambient current patterns in the vicinity of the proposed intake structure(s) (from ESRP 2.3.1)
- descriptions of other intake system design and performance characteristics affecting hydrodynamics (e.g., horizontal and vertical approach velocities, geometry of intake canals, submerged riprap) (from the environmental report [ER])
- descriptions of spatial and temporal alterations of the ambient flow field and of any other physical hydrologic effects induced by intake-system operation (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the hydrodynamic physical impacts at the proposed plant sites are based on the relevant requirements of the following:

- 33 CFR 322 with respect to definition of activities requiring permits
- 40 CFR 6, Appendix A, with respect to procedures on floodplain and wetlands protection
- 40 CFR 122 with respect to NPDES permit conditions for discharges, including storm water discharges
- 40 CFR 149 with respect to possible supplemental restrictions on waste disposal and water use in or above a sole source aquifer
- Federal, State, regional, local, and affected Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Compliance with environmental quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will establish its own impact determination.

- Because water quality and water supply are interdependent, changes in water quality must be considered simultaneously with changes in water supply. In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the States' role in regulating water rights.

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), provides guidance on the format and content of ERs including hydrology, water-use, and water-quality issues.

Technical Rationale

The technical rationale for evaluating the applicant's hydrodynamic descriptions and physical impacts is discussed in the following paragraphs:

A detailed and thorough description of the hydrodynamic and physical impacts of the cooling system intakes is essential for the evaluation of potential impacts to the environment that may result from plant construction or operation.

III. REVIEW PROCEDURES

The reviewer's description of intake hydrodynamics should be linked to the environmental descriptions provided by ESRPs 2.3.1, 3.3, and 3.4 to ensure that water body characteristics affecting intake hydrodynamics are described in sufficient detail to allow prediction of the flow field induced by the operation of the intake system. The reviewer's analysis of physical impacts of intake system operation should be linked to the environmental descriptions and impact analyses of ESRPs 2.4.2, 5.3.1.2, and 5.3.2.1 to ensure that those environmental factors most likely to be affected are described in sufficient

detail to permit assessment of the predicted changes or impacts. The extent of the description of intake hydrodynamics and analysis of physical impacts should be governed by the magnitude of potential intake system impacts to aquatic biota.

Intake-Hydrodynamic Description

The reviewer should take the following steps to develop a description of the intake hydrodynamics:

(1) Conduct a simple hydrodynamic analysis (e.g., calculate of the induced potential flow field by standard procedures and prepare an intake system hydrodynamic description.

- Discuss this with reviewers for ESRPs 2.4.2 and 5.3.1.2 to determine its adequacy for use in predicting intake system impacts to aquatic biota.

- When determined that the induced flow fields will result in only minor impacts on aquatic biota (or that no biota will be impacted), this portion of the analysis is complete.

(2) When it is determined that the simple hydrodynamic analysis is insufficient (e.g., the analysis results in predictions of significant adverse impact; there are large populations of "important" aquatic biota in the vicinity of the intake), prepare a detailed analysis of intake hydrodynamics consisting of

- a review of any applicant supplied flow field predictions or

- a reviewer prepared prediction of the induced flow field based on modeling procedures.

  - Consult with the reviewers for ESRPs 2.4.2 and 5.3.1.2 to determine the extent of the surface-water body to be analyzed.

  - For once through cooling systems, consult with the reviewer for ESRP 5.3.2.1 to ensure that the area of the water body to be analyzed is sufficient to permit analysis of potential recirculation of discharged cooling water.

  - Provide a quantitative description of the induced flow field taking into account the ambient currents.

  - Provide velocity vectors or other descriptors showing the areal extent of the region affected by the induced flow field.

Physical Impacts of Intakes

The reviewer should take the following steps to analyze the physical impacts of the intake system:

(1) Identify and analyze physical changes resulting from intake system operation, including

- shoreline erosion
- bottom scouring
- induced turbidity
- silt buildup.

Staff experience has indicated that the impacts associated with these physical changes are minor, and mitigative action or consideration of alternatives has not been required.

(2) Unless adverse impacts have been identified, no further evaluation is required.

The reviewer should ensure that the description of the intake flow field is adequate to serve as a basis for the impact assessment of ESRP 5.3.1.2 and for providing flow patterns necessary for the assessment of potential heated water recirculation conducted in ESRP 5.3.2.1.

The reviewer should ensure that analyses involving mathematical or physical modeling of intake flow fields are appropriate for the specific situation being modeled, have been verified or shown to be conservative, and are documented and referenced. The reviewer should consider the procedures of Regulatory Guides 4.4, *Reporting Procedure for Mathematical Models Selected for Predict Heated Effluent Dispersion in Natural Water Bodies* (NRC 1974), and 1.125, Rev. 1, *Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants* (NRC 1978), in making this evaluation. For analyses involving less detailed procedures than mathematical or physical models, the reviewer should ensure that the procedures used were appropriate for the specific situation and were adequately conservative.

For specific physical impacts identified by the "Review Procedures" section, the reviewer should evaluate each impact with regard to water standards and guides or good operating procedures for intake systems. Unless potentially severe impacts have been identified, no further evaluation is required.

IV. EVALUATION FINDINGS

Input to the EIS should contain the following: (1) a physical description of the induced hydrodynamic flow field resulting from operation of the intake system, (2) a description and assessment of physical impacts resulting from intake system operation, (3) the basis for the staff's review and analysis, and (4) staff evaluations and conclusions. The extent of the hydrodynamic description input to the EIS should be governed by the potential for impacts on aquatic biota (ESRP 5.3.1.2). The extent of the physical impacts to be included should be determined by the results of the "Review Procedures" section in identifying potentially significant changes.

The following information should be included in the EIS:

- hydrodynamic description of the intake induced flow fields, including effects of ambient flow patterns. Tables or figures may be used.

- a description and assessment of the analysis technique used
- the intake flow conditions that may result in severe impacts on aquatic biota
- a description and assessment of potential physical impacts.

Evaluation of each identified impact will result in one of the following conclusions:

- *The impact is minor, and mitigation is not required.*
- *The impact is adverse, but can be mitigated by specific design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the project manager and the reviewer for ESRP 9.3.2 for verification that any proposed modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications, measures, and controls to limit the corresponding impact. These lists will be provided to the reviewer for ESRP 5.10.
- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the reviewer for ESRP 9.4 that an analysis and evaluation of alternative designs or procedures are required. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should provide this information to the reviewer for ESRP 10.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 149, "Sole Source Aquifers."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1037; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

U.S. Nuclear Regulatory Commission (NRC). 1974. *Reporting Procedure for Mathematical Models Selected for Predict Heated Effluent Dispersion in Natural Water Bodies*. Regulatory Guide 4.4, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1978. *Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants*. Regulatory Guide 1.125, Rev 1, Washington, D. C.

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5.3.1.2 AQUATIC ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and assessment of potential plant intake system impacts on aquatic ecosystems.

The scope of the review directed by this plan should include an analysis of the effects of entrapment, impingement, and entrainment in sufficient detail to allow the reviewer to predict potential impacts on "important species" and to evaluate the significance of such impacts. The review should be extended to consider the effects of altered circulation patterns and reentrainment of heated effluents if these effects are determined to be significant.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.4.2. Obtain a description of the aquatic ecology in the vicinity of the site, especially those resources potentially affected by the cooling-water intake system.
- ESRP 3.1. Obtain information about the power plant's external appearance and layout in enough detail to support the analyses made in ESRP 5.3.1.2.
- ESRP 3.4.1. Obtain a description of the cooling system and its operational modes in enough detail to support the analyses made in ESRP 5.3.1.2.

- ESRP 5.2.1. Obtain information regarding hydrological alterations from operation and the adequacy of the plant water supply so that an evaluation of impacts to the aquatic ecosystem from the cooling system intake can be completed.

- ESRP 5.2.2. Provide information regarding impacts on the aquatic ecosystem from the cooling system intake so that an evaluation of impacts of operation on plant water use can be completed.

- ESRP 5.3.1.1. Obtain information regarding physical impacts caused by the flow field induced by the intake system so that an evaluation of impacts on the aquatic ecosystem from the cooling system intake can be completed.

- ESRP 5.10. Provide a list of potentially adverse impacts of the cooling system intake on aquatic biota and a list of applicant commitments to limit these adverse impacts.

- ESRP 6.5.2. Provide a discussion of any preoperational baseline monitoring programs necessary to assess impacts of intake system operation.

- ESRP 9.4.2. Provide a list of adverse impacts of intake system operation that could be mitigated or avoided through alternative system design, location, or operation and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable adverse impacts on aquatic biota that are predicted to occur as a result of intake system operation.

- ESRP 10.2. Provide a summary of irreversible and irretrievable commitments of aquatic resources that are predicted to occur as a result of intake system operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following information should be obtained:

- susceptibility of "important" aquatic species (as defined in Table 2.4.2-1) to entrainment, entrapment, and impingement (from the environmental report [ER] and the general literature)

- the economic value of the species for local or regional commercial and recreational fisheries. For species that are commercially or recreationally valuable, estimates of natural survival rates up to those life stages at which the species are recruited to the harvestable or parent stocks (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies).

- for those "important" species potentially affected by plant operation, estimates of the regional standing stocks (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- for once through systems, transit time from the intake structure to the point of discharge to a receiving water body (from the ER).

Besides the specific site and vicinity information listed here, additional data will be needed to review the impacts on the aquatic ecology from operation of the cooling intake system. This background information can be found in ESRPs 2.3.1, 2.3.3, and 2.4.2 and concerns "important species" as well as the hydrological and ecological conditions on and in the vicinity of the site.

Additional information about the plant design and operating procedures should be taken from other ESRPs, including 3.4.2, 5.3.1.1, and 5.3.2.1. These sections describe components of the cooling system and the hydrodynamics and physical impacts of the intake and discharge.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of construction impacts on aquatic resources in the vicinity of the site and transmission corridors are based on the relevant requirements of the following:

- 10 CFR 51.45 with respect to ERs and the analysis of potential impacts contained therein

- 10 CFR 51.75 with respect to descriptions of the environment affected by the issuance of a construction permit

- 10 CFR 51.95 with respect to the preparation of supplemental EISs in support of the issuance of an operating license

- 10 CFR 52, Subpart A, with respect to descriptions of the environment affected by the issuance of an early site permit

- 40 CFR 122 with respect to NPDES permit conditions specified in the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act

- Coastal Zone Management Act of 1972 with respect to natural resources and land or water use of the coastal zone

- Endangered Species Act of 1973, as amended, with respect to identifying threatened and endangered species, critical habitats, and initiating formal or informal consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service

- Clean Water Act with respect to restoration and maintenance of the chemical, physical, and biological integrity of water resources

- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources in the planning of development projects that affect water resources

- Marine Mammal Protection Act of 1972 with respect to the protection of marine mammals

- Marine Protection, Research, and Sanctuaries Act of 1972 with respect to the dumping of dredged material into the ocean

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance to the applicant concerning the analysis of potential impacts of operation of the cooling water intake system. The reviewer should ensure that the applicant's analysis is sufficient to evaluate impacts during station operation.

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998) contains guidance concerning the ecological systems and biota at potential sites and requires that their environs be sufficiently well known to allow reasonably certain predictions of impacts and that there are no unacceptable or unnecessary deleterious impacts on populations of important species or on ecological systems from the construction or operation of a nuclear power station. This guide also provides regulatory positions concerning entrainment, impingement, or other forms of entrapment and effects of cooling systems on aquatic species migration routes.

- Compliance with environmental quality standards and requirements of the Clean Water Act is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will conduct its own assessment and use it in its determination of the overall benefit-cost balance.

- Memorandum of Understanding Between the Corps of Engineers, U.S. Army, and the NRC for the Regulation of Nuclear Power Plants (40 FR 37110) with respect to the NRC exercising the primary responsibility in conducting environmental reviews and in preparing EISs for nuclear power stations. However, the Corps of Engineers will participate with the NRC in the preparation of EISs by helping to draft material for sections covering (1) coastal erosion and other shoreline modifications,

(2) siltation and sedimentation processes, (3) dredging activities and disposal of dredged materials, and (4) location of structures affecting navigable waters.

- Second Memorandum of Understanding and Policy Statement Regarding Implementation of Certain NRC and EPA Responsibilities, serves as the legal basis for NRC decisionmaking concerning licensing matters covered by NEPA and Section 511 of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act.

Technical Rationale

The technical rationale for evaluating the applicant's plant system impacts on aquatic ecosystem intakes is discussed in the following paragraph:

The EIS should include an analysis that considers the environmental effects of the proposed cooling water intake system and the alternatives available for reducing or avoiding adverse environmental effects, as well as any environmental benefits that may result from the proposed action. Following the acceptance criteria listed above will help ensure that the environmental impacts of the proposed cooling water intake system are considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

The impacts from cooling water intake are regulated through the National Pollutant Discharge Elimination System (NPDES) permit system. The Clean Water Act requires that the location, design, construction, and capacity of the cooling water intake structure reflect the best technology available for minimizing environmental impacts. Responsibility for making this determination rests with the EPA or with its designees.

In the most practical terms, the reviewer's final evaluation is determined through professional judgment based on the pertinent data and analyses. The reviewer may refer to earlier NRC environmental reviews in which evaluation of intake system operational impacts has been important.

The reviewer should take the following steps:

(1) Determine whether the applicant has provided a current NPDES permit with a 316(b) determination, if appropriate, or equivalent State permits and supporting documentation. If these documents are not available, not current, or do not reflect conditions during the license renewal term, continue the analysis at Step (2). Otherwise, prepare a statement for the SEIS describing the potential for entrainment of fish and shellfish in early life stages that

- summarizes the permitting documents that have been reviewed
- states that a current NPDES permit and 316(b) determination are available and current

- concludes that there are no cooling water intake system impacts of entrainment on fish and shellfish in early life stages.

(2) Identify the "important" aquatic organisms and their life stages susceptible to entrapment, impingement, or entrainment, coordinating efforts with the reviewer of ESRP 2.4.2 to ensure that these susceptible "important" species are also described in that ESRP.

If fish and shellfish species are present and are susceptible to entrainment such that effects will be detectable or may destabilize or noticeably alter fish or shellfish population levels, then continue the analysis at Step (3). Otherwise, prepare a statement for the supplemental EIS (SEIS) describing the potential for entrainment of fish and shellfish in early life stages that

- summarizes the permitting information, species data, and methods for quantifying fish and shellfish entrainment that have been reviewed

- states that there are no populations of fish or shellfish species present in the vicinity of the site that will be entrained in the cooling water intake system to the point where changes in their population levels are detectable

- concludes that, because fish and shellfish populations will remain stable even if some are entrained, the cooling water intake system impacts of entrainment on fish and shellfish in early life stages are SMALL within the context of the analysis in NUREG-1437.

(3) Estimate the levels of susceptibility in either qualitative or quantitative terms, or both. Methods for quantifying entrapment and impingement susceptibilities are not well developed; therefore, it may be necessary to draw on the experience of comparable, currently operating power stations to predict whether the potential is HIGH, MEDIUM, or LOW for the proposed plant. Methods for quantifying entrainment susceptibilities are available; however, they are generally applicable to specific habitat species station characteristics.

- Ensure that assumptions made in available model developments are valid for the case under review.

- Consider habitat type in determining levels of susceptibility.

(4) After identifying the "important" species and determining their susceptibility, estimate the survival rates for those species impinged or entrained by relying on experience at other stations. Certain species have been shown to be especially fragile (e.g., threadfin shad, menhaden, bay anchovy), whereas some shellfish are much hardier (e.g., blue crab and penaeid shrimp).

- Consider the design and proposed operation of any proposed screen wash and fish return system.

- Consider the potential value of such a system, if a return system is not proposed.

- Assume 100% mortality for all entrained biota, considering the following:

  - For once through systems, however, you may perform an analysis using a refined estimate of mortality and factoring in species tolerances to thermal, chemical, mechanical, and pressure stresses; transit time through the system; and plant operational characteristics.

  - For the special case of a multipurpose cooling pond for which makeup water is provided from another water body, the impacts should be considered at both the plant intake and the source water intake.

(5) Consider the potential for altered hydrodynamic characteristics induced by inlet system operation (e.g., altered circulation patterns) to affect attraction and entrapment of aquatic biota, and consult with the reviewer for ESRP 5.3.1.1 to determine the extent and seasonal variation of any such alterations.

(6) Consult with the reviewer for ESRP 5.3.2.1 to determine if there is any potential for the recirculation of heated effluent from the plant discharge system. If recirculation is predicted, analyze the potential effects of increased impacts of entrapment, entrainment, and impingement.

(7) In this final step, estimate the magnitude of the potential impingement and entrainment impacts on the species populations and the aquatic ecosystem.

  - Use the results of Step 4 as the starting point (i.e., the potential station cropping rates for phytoplankton, zooplankton, and meroplankton, including fish eggs and larvae, and juvenile stages of "important" species).

  - Consider these cropping rates in relation to natural mortality rates, reproductive rates, and standing stock estimates for the species populations.

  - Consider other existing stresses (cumulative mortality) to the fragile species (e.g., impacts of other electrical generating stations sited nearby).

In general, the entrainment cropping of phytoplankton and zooplankton will not impact these communities due to the short reproductive cycles for these species. More detailed consideration should be given those species with annual reproductive cycles, such as most fish and shellfish.

The reviewer may assume, for a first approximation, that plant cropping translates directly to a reduction in the harvestable or parent stocks. Where possible, this impact should be expressed in quantitative units such as (1) catch per unit effort, (2) harvestable stock by weight, (3) recruitment in numbers, (4) dollar values, and (5) numbers or percentages of specific size, age group, or life stage. The reviewer may use more refined analyses (e.g., population modeling, compensation factors) when results suggest that additional precision is needed.

IV. EVALUATION FINDINGS

The depth and extent of input to the EIS will be governed by the attributes of the aquatic ecological resources that could be affected by operation of the station's heat dissipation systems and by the magnitude of the expected impacts on these resources. This section of the EIS should present (1) a list of adverse impacts of cooling system intake operation to aquatic ecosystems, (2) a list of the impacts for which there are measures or controls to limit adverse impacts and the associated measures and controls, (3) the applicant's commitments to limit these impacts, and (4) the staff's evaluation of the adequacy of the applicant's measures and controls to limit adverse impacts. This information should be summarized for the reviewer of ESRP 5.10.

The staff's analysis may be provided by referencing the aquatic biota descriptions of ESRP 2.4.2 and describing in brief detail the impacts on those biota that are "important" and susceptible to entrainment, entrapment, or impingement. Types, life stages, and relative abundance of impacted "important" biota should be described, along with specific aspects of proposed intake system operation responsible for such impacts on these biota. This section should provide estimates of survival from these intake system impacts and estimates of the relative or absolute losses to the impacted populations.

Staff conclusions should contain an evaluation of the significance of losses to the populations of "important" species, including a determination of whether these losses will constitute an adverse impact that should be mitigated or avoided. This section may include a summary of staff consultations with the appropriate NPDES administrative agencies having responsibilities under the FWPCA. Any studies or environmental investigations performed by these agencies that address intake system impacts should be described or referenced.

If any threatened or endangered species will be potentially affected by the operation of the cooling water intake system, a Section 7 consultation process should be initiated with the appropriate Federal agency (U.S. Fish and Wildlife Service or National Marine Fisheries Service) must be arranged. The EIS should contain a summary of the results of such consultations if they occur.

If the reviewer verifies that sufficient information has been provided in accordance with the guidance provided by this ESRP section, then the evaluation will support one of the following concluding statements, to be included in the EIS:

- The staff reviewed the available information relative to potential impacts of the cooling water intake system on the site's aquatic ecology. Based on this review, the staff concluded that the impact is small and mitigation was considered but was deemed not warranted.

- The staff reviewed the available information relative to potential impacts of the cooling water intake system on the site's aquatic ecology. Based on this review, the staff concluded that the impacts are moderate (or large). Potential mitigation measures have been identified and evaluated.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, Subpart A, "Early Site Permits."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Marine Mammal Protection Act of 1972, as amended, 16 USC 1361 et seq.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

Memorandum of Understanding between the Corps of Engineers, U.S. Army, and the U.S. Nuclear Regulatory Commission for the Regulation of Nuclear Power Plants, 40 *Federal Register* 37110 (August 25, 1975).

Second Memorandum of Understanding and Policy Statement Regarding Implementation of Certain NRC and EPA Responsibilities, 40 *Federal Register* 60115 (December 31, 1975).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vol. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations.* Regulatory Guide 4.7, Rev. 2, Washington, D. C.

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5.3.2 DISCHARGE SYSTEM

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the impacts of the discharge system during station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.3.2.1 and 5.3.2.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluation of the applicant's discharge system is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.3.2.1 and 5.3.2.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.3.2.1 THERMAL DESCRIPTION AND PHYSICAL IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description and assessment of the proposed plant's hydrothermal discharge and associated physical impacts.

The scope of the review directed by this plan should include the analysis of temporal and spatial temperature distributions in the receiving water bodies and any potential physical impacts (e.g., increased turbidity, scouring, erosion, sedimentation) on receiving water bodies resulting from the plant's thermal discharges. Where such discharges may be mixed with thermal discharges from existing station steam electric generating plants, the reviewer should determine the incremental impact (either beneficial or adverse) attributable to the proposed plant. The review should be in sufficient detail to predict and assess potential impacts and to discuss how these impacts should be treated in the licensing process. Where necessary, the reviewer should identify and evaluate alternative designs, practices, or procedures that would mitigate adverse impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain descriptions of the hydrology of the region surrounding the proposed plant site (specifically, the hydrology of the surface water bodies that will be affected by the discharge system).

- ESRP 2.3.2. Obtain descriptions of the regional water uses (e.g., the location and nature of water users and water-use areas) for the area surrounding the proposed plant site (specifically, the uses of the surface water bodies that will be affected by the discharge system).

- ESRP 2.4.2. Obtain descriptions of the baseline aquatic ecology of the surface-water bodies that would be affected by the proposed plant.

- ESRP 2.7. Obtain descriptions of the meteorology at the site of the proposed plant.

- ESRP 3.1. Obtain descriptions of the layout of the proposed plant (specifically, the layout with respect to the main water bodies, including locations of all intakes and discharges).

- ESRPs 3.3.1 and 3.3.2. Obtain descriptions of the expected water use of the proposed plant.

- ESRPs 3.4.1 and 3.4.2. Obtain descriptions of the cooling system of the proposed plant.

- ESRP 5.2.1. Obtain descriptions of the operational hydrologic alterations that will support the descriptions of the discharge thermal plumes.

- ESRP 5.3.1.1. Obtain descriptions of the physical impacts to surface-water bodies caused by the intake system of the proposed plant (if the same water bodies are used for discharge to the cooling system).

- ESRP 5.3.2.2. Obtain input regarding the potential for impacts of the thermal discharges on aquatic biota (which will be used to determine the appropriate extent of the thermal discharge description required for the environmental impact statement [EIS]).

- ESRPs 5.3.1.1 and 5.3.2.2. Provide results of the staff's thermal plume analyses.

- ESRPs 5.4 and 5.5. Provide predicted dilution factors at specified locations.

- ESRP 5.8.1. Provide a summary of the physical impacts related to the presence and operation of the discharge system.

- ESRP 5.10. Provide a list of recommended measures and controls to limit or minimize adverse discharge system physical impacts.

- ESRP 6.1. Provide a discussion of any required preoperational baseline monitoring programs necessary to assess physical impacts of discharge system operation.

- ESRPs 6.3 and 6.6. Provide input regarding the need for and possible limitation on monitoring activities as a result of the presence or operation of the cooling discharge system.

- ESRP 9.4.2. Provide a list of adverse physical impacts of discharge system operation that could be mitigated or avoided through alternative system design or operational practices and procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a list of the unavoidable adverse impacts that are predicted to occur as a result of the proposed operational activity.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following information should be obtained:

- receiving surface water bodies

  - bathymetry of the water bodies that may be affected by operation of the plant discharge system, with detailed data in the vicinity of the discharge (from ESRP 2.3.1)

  - maps depicting station layout with respect to water bodies, including the locations of all intakes and discharges (from ESRP 3.1)

  - maximum, average maximum, average, average minimum, and minimum monthly temperatures in the water bodies (from ESRP 2.3.1)

  - erosion characteristics and sediment transport (including rate, bed and suspended load fractions, and gradation analyses) (from ESRP 2.3.1)

  - for freshwater streams: maximum, average-maximum, average, average minimum, and minimum monthly flow rates; historical drought stages and flow rates by month, 7-day once-in-10-years low flow; important short duration fluctuations (e.g., diurnal release variations from peaking operation of upstream hydroelectric plant, diurnal temperature variations); velocity and temperature distributions (horizontal and vertical) near the discharge structure and downstream to the area of total mixing (from the environmental report [ER] and ESRP 2.3.1)

  - for lakes and impoundments: description of the lake or impoundment geometry; location and elevation of impoundment outlets; elevation area capacity curves; summary description of operating rules; maximum, average maximum, average, average minimum, and minimum monthly inflow and outflow rates; temperature distributions (horizontal and vertical); and seasonal variations of density induced currents (from ESRP 2.3.1)

  - for estuaries and oceans: seasonal variations in the shoreline and bottom geometry due to sediment transport; tidal current patterns (velocities and phases), range, and excursion; nontidal circulation patterns including frequency distributions of current speed, direction, and persistence;

and temperature and salinity distribution (horizontal and vertical) including temporal variations. For estuaries, maximum, average maximum, average, average minimum, and minimum monthly river discharge and flushing characteristics (from ESRP 2.3.1).

- meteorology, including
  - onsite meteorological data (from ESRP 2.7)
  - National Oceanographic and Atmospheric Administration (NOAA) National Climatic Data Center meteorological data for the nearest National Weather Service (NWS) station (from ESRP 2.7)
  - the elevation of instruments measuring wind speeds, wet bulb temperatures, and humidities (from ESRP 2.7).
- discharge structure(s), including
  - detailed drawings of the discharge structure(s), including relationship of structure(s) to the water surface (normal and minimum) and water body bathymetry (from ESRP 3.4.2)
  - water flow rates, velocities, and temperatures in the discharge stream(s) as a function of operating conditions (from ESRP 3.4.2).
- applicant's mathematical models (from the ER), including
  - theory, assumptions, and basis for applicability
  - procedures used to estimate model parameters (e.g., diffusion coefficients)
  - model verification (if any)
  - the applicant's predicted temperature distributions, areas for isotherms, dilution rates, and time of passage through plume.
- applicant's physical models (from the ER), including
  - physical model facilities (e.g., dimensions of the plume and flow rates)
  - modeling techniques and scaling relationships
  - data collection and analysis techniques (e.g., number and locations of temperature probes, infrared mapping)

- prototype verification (if any)

- the applicant's flow fields and temperature distributions for critical and average hydrological conditions.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of thermal impacts at the proposed plant sites are based on the relevant requirements of the following regulations:

- 33 CFR 322 with respect to definition of activities requiring permits
- 40 CFR 6, Appendix A, with respect to procedures on floodplain and wetlands protection
- 40 CFR 122 with respect to National Pollution Discharge Elimination System (NPDES) permit conditions for discharges
- 40 CFR 423 with respect to effluent limitations on existing and new point sources
- Federal, State, regional, local, and affected Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Compliance with environmental quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. If no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will determine the impact.

- Because water quality and water supply are interdependent, changes in water quality must be considered simultaneously with changes in water supply. In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the State's role in regulating water rights.

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the format and content of ERs including hydrology, water-use, and water-quality issues.

Technical Rationale

The technical rationale for evaluating the applicant's thermal description and physical impacts is discussed in the following paragraph:

A detailed and thorough description of the thermal and physical impacts of the cooling system's discharge is essential for the evaluation of potential impacts on the environment that may result from plant, construction or operation.

III. REVIEW PROCEDURES

The reviewer's analysis of the thermal discharges should be linked to the environmental descriptions provided by ESRPs 2.3, 2.4.2, 2.7, 3.3, and 3.4 to ensure that the physical environmental factors most likely to be impacted by the proposed plant operation are described in sufficient detail to permit assessment of the predicted impacts.

The reviewer should take the following steps:

(1) Coordinate with the reviewer for ESRP 5.3.2.2 to ensure that those biotic environmental factors (e.g., aquatic biota) most likely to be impacted by the thermal discharge are described in sufficient detail to permit assessment of the predicted changes or impacts. If the proposed plant is to be located at a station with an existing generating plant and the proposed plant thermal discharges will be mixed with thermal discharges from the existing plant, limit the analysis (and subsequent evaluation) to the incremental impacts resulting from operation of the proposed plant.

(2) Determine dilution factors at specific receiving water body locations when requested to do so by the reviewers for ESRPs 5.4 or 5.5.

(3) Consider impacts that may result from operation of the following:

- once through cooling systems starting at the condenser discharge
- cooling towers, including helper towers, starting at the point of the cooling tower water blowdown
- spray canals, including helper spray canals, starting at the point of the spray canal water blowdown
- cooling lakes and multi-purpose cooling ponds, starting at the point of the condenser discharge

- cooling ponds used only for heat dissipation, starting at the point of pond discharge to receiving water bodies.

(4) Scale the scope of the analysis to the level of the anticipated impacts.

- If the thermally affected discharge area will be relatively small and have low ecological impacts, then use simple methods of analysis and conservative assumptions.

- If the available data indicate a significant potential for problems, such as development of a thermal block, recirculation of heated effluent to the cooling water intake and thermal buildup, discharge plumes attaching to shorelines, violation of thermal standards, or important impacts to biota, then perform a hydrothermal analysis sufficient to produce a sound basis for evaluating the potential environmental impacts.

(5) Base analysis of the hydrothermal data on the applicant's mathematical and/or physical models and on field or tracer studies performed by the applicant.

- Consult Regulatory Guides 4.4, *Reporting Procedure for Mathematical Models Selected to Predict Heated Effluent Dispersion in Natural Water Bodies* (NRC 1974) and 1.125, Rev. 1, *Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants* (NRC 1978), to analyze the applicant's mathematical or physical models.

- If the reviewer's evaluation of these data verifies the validity of the applicant's approach and results, this should constitute an adequate independent analysis.

- If the reviewer is unable to verify the applicant's results by this method, perform an independent assessment, using the methods described below.

(6) Select an appropriate modeling procedure based on the following considerations: (1) the type of outfall and discharge characteristics, (2) physical characteristics of the receiving water bodies, (3) hydrological flow regimes, (4) hydrodynamic characteristics of the receiving water, (5) water-use patterns in the vicinity of the station, (6) quantity and temperature of the effluents, (7) meteorology, and (8) thermal assimilative capacity of the receiving waters.

- See EPA (1993) and Fisher et al. (1979) for discussions on the applicability of a variety of mathematical thermal discharge models.

- Also consider new models or improved existing models when selecting a mathematical model.

(7) Assess physical changes resulting from the discharge system operation, including shoreline erosion, bottom scouring, increased turbidity and siltation.

- If no severe impacts can be predicted, no further analysis is necessary.

- If potentially severe impacts are identified, consider using mathematical modeling or physical modeling to quantify them.

(8) Determine compliance with applicable regulations.

- Where required, consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies.

- Become familiar with the provisions of the Second Memorandum of Understanding between NRC and EPA.

IV. EVALUATION FINDINGS

Input to the EIS should include (1) a description of the thermally affected area, (2) the public disclosure of physical impacts resulting from the discharge system, (3) the basis for the staff analysis, and (4) staff evaluations and conclusions. The following information should be included in the EIS:

- a hydrothermal description of the affected area

- tables or figures depicting isotherms, areas within the isotherms, streamlines, streaklines, or velocity vectors as a function of temporal variations

- descriptions of thermal blocks, recirculation, discharge plume attachment to shorelines, thermal buildup, violation of standards, and potential impacts, such as increased turbidity, scouring, erosion, or sedimentation.

The reviewer should verify that sufficient information has been provided in accordance with the relevant requirements and that the evaluation supports the following type of statement to be included in the EIS:

> Based on the applicant's description of the methodologies used to conduct a hydrothermal analysis of the discharge system of the proposed plant's cooling system, the staff concludes that characterization of the physical effects of the hydrothermal discharges is valid and adequate to evaluate the impacts of the plant construction and operation on the aquatic biota in the affected surface water body environment.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 423, "Steam Electric Power Generating Point Source Category."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fischer, H. B., E. J. List, R. C. T. Koh, J. Imberger, and N. H. Brooks. 1979. *Mixing in Inland and Coastal Waters*, Academic Press, New York.

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1037; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

Second Memorandum of Understanding and Policy Statement Regarding Implementation of Certain NRC and EPA Responsibilities, 40 *Federal Register 60115* (December 31 1975).

U.S. Environmental Protection Agency (EPA). October 1993. *Cormix Version 2.10 Users Manual.*

U.S. Nuclear Regulatory Commission. 1974. *Reporting Procedure for Mathematical Models Selected to Predict Heated Effluent Dispersion in Natural Water Bodies*. Regulatory Guide 4.4, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1978. *Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants*. Regulatory Guide 1.125, Rev 1, Washington, D. C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.3.2.2 AQUATIC ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description, quantification, and assessment of potential thermal, physical, and chemical stresses to aquatic organisms that may occur as a result of plant cooling system discharges to receiving water bodies. The principal objective of this ESRP is to predict and assess impacts to "important" aquatic populations in the vicinity of the station and evaluate the significance of such impacts. "Important" resources are defined in ESRP 2.4.2, Review Procedures.

The scope of the review directed by this plan should include the analysis of alterations to the receiving water body resulting from plant thermal, physical, and chemical discharges in sufficient detail to predict and determine the nature and extent of potential impacts on aquatic ecosystems.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain information about the hydrology of the site and environs in sufficient detail to allow analysis of impacts on the aquatic ecosystem from cooling system discharge.

- ESRP 2.3.3. Obtain information concerning water quality at or in the vicinity of the site in sufficient detail to determine impacts on the aquatic environment, especially as they relate to the cooling system and discharge.

- ESRP 2.4.2. Obtain information about the aquatic environment to determine the aspects of the aquatic environment that could potentially be impacted by operation of the cooling discharge system.

- ESRP 3.6.1. Obtain information concerning chemicals or biocides used in relation to the cooling system that could potentially impact the aquatic ecology at the site and its environs.

- ESRP 3.6.2. Obtain information concerning sanitary system effluents that could potentially impact the aquatic ecology at the site and its environs.

- ESRP 5.2.1. Obtain information regarding hydrological alterations from operation and the adequacy of the plant water supply so that an evaluation of impacts on the aquatic ecosystem from the cooling system discharge can be completed.

- ESRP 5.2.2. Provide information regarding impacts on the aquatic ecosystem from the cooling system discharge so that an evaluation of impacts of operation on plant water use can be completed.

- ESRP 5.3.2.1. Obtain information about physical impacts and thermal plumes in enough detail to determine potential impacts on the aquatic ecosystem.

- ESRP 5.5.1. Provide information regarding impacts on the aquatic ecosystem from the cooling system discharge so that an evaluation of impacts from discharge of nonradioactive effluents can be completed.

- ESRP 5.10. Provide a list of applicant commitments and staff evaluations of measures and controls to limit adverse discharge system aquatic impacts.

- ESRP 6.5.2. Provide a discussion of any preoperational baseline monitoring programs necessary to assess impacts of discharge system operation.

- ESRP 9.4.1. Provide a list of adverse impacts of heat-dissipation systems that could be mitigated through alternative system design, location, or operation, and assist in determining appropriate alternatives.

- ESRP 9.4.2. Provide a list of adverse impacts of circulating-water-system operation that could be mitigated or avoided through alternative system design, location, or operation, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable adverse impacts on aquatic biota that are predicted to occur as a result of discharge system operation.

- ESRP 10.2. Provide a summary of irreversible and irretrievable commitments of aquatic resources that are predicted to occur as a result of discharge system operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following types of data or information should be obtained:

- obtain a copy of the plant's current NPDES permit. If this is not available, obtain the following:
  - thermal
  - data on temperature duration mortality relationship of susceptible "important" aquatic species (from the environmental report [ER] and the general literature)
  - additional information about thermal characteristics as they relate to the discharge system taken from other ESRPs, including ESRPs 2.4.2 and 5.3.2.1, which describe the aquatic ecology of the site and its environs and the physical impacts of the discharge system.
- chemical
  - tolerances of the "important" aquatic species identified in ESRP 2.4.2 to acute and chronic exposure to chemicals in the plant discharge (from the ER and the general literature)
  - tolerances of "important" aquatic species identified in ESRP 2.4.2 to acute and chronic exposure to dissolved gases (from the ER and the general literature)
  - additional information on the biological effects of chemical alterations to the receiving water body obtained from other ESRPs, including ESRPs 2.3.3 and 3.6.1, which describe the water quality of the site and chemical and biocidal nonradiological wastes.
- physical, including information regarding biological effects of physical alterations to the receiving water body obtained from other ESRPs, including ESRPs 2.3.1 and 5.3.2.1, which discuss the hydrology of the site and the physical impacts of the discharge system
- a description of the condenser cooling system because its configuration can determine which permits must be acquired and the severity of impacts on particular aquatic organisms or systems
- a description of applicable State and Federal (40 CFR 423) effluent guidelines and the thermal standards or limitations applicable to the water body to which the discharge is made (including maximum permissible temperature, maximum permissible temperature increase, mixing zones, and maximum rates of increase and decrease) and whether and to what extent these standards or limitations have been approved by the Administrator of the EPA in accordance with the Federal Water Pollution Control Act (FWPCA), as amended.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of impacts to aquatic ecosystems from the discharge system are based on the relevant requirements of the following:

- 10 CFR 51.45 with respect to ERs and the analysis of potential impacts contained therein
- 10 CFR 51.75 with respect to analysis of impacts to the terrestrial environment affected by the issuance of a construction permit
- 10 CFR 52, Subpart A, with respect to analysis of impacts to the terrestrial environment affected by the issuance of an early site permit
- 10 CFR 51.95 with respect to the preparation of supplemental environmental impact statements (EISs) in support of the issuance of an operating license
- 40 CFR 122 with respect to EPA administered programs, especially the National Pollutant Discharge Elimination System (NPDES)
- 40 CFR 423 with respect to effluent guidelines and thermal standards
- Coastal Zone Management Act of 1972 with respect to natural resources, and land or water use of the coastal zone
- Endangered Species Act of 1973, as amended, with respect to identifying threatened or endangered species and critical habitats and formal or informal consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service
- Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act (CWA), Amendments of 1972, Sections 402 and 316[a]), with respect to restoration and maintenance of the chemical, physical, and biological integrity of water resources
- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources and the planning of development projects that affect water resources
- Marine Mammal Protection Act of 1972 with respect to the protection of marine animals
- Marine Protection, Research, and Sanctuaries Act of 1972 with respect to the dumping of dredged material into the ocean
- Rivers and Harbors Appropriations Act of 1899 with respect to the deposition of debris in navigable waters, or tributaries to such waters.

Regulatory guidance and specific criteria to meet the requirements identified above are presented in the following guidance documents:

- Compliance with environmental quality standards and requirements of the Clean Water Act is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will conduct its own assessment and use it in its determination of the overall benefit-cost balance.

- Memorandum of Understanding between the Corps of Engineers, U. S. Army, and the USNRC for the Regulation of Nuclear Power Plants, with respect to the NRC exercising the primary responsibility in conducting environmental reviews and in preparing EISs for nuclear power stations. However, the Corps of Engineers will participate with the NRC in the preparation of EISs by helping to draft material for sections covering (1) coastal erosion and other shoreline modifications, (2) siltation and sedimentation processes, (3) dredging activities and disposal of dredged materials, and (4) location of structures affecting navigable waters.

Technical Rationale

The technical rationale for evaluating the applicant's potential plant discharge system impacts to the aquatic ecosystem is discussed in the following paragraph:

The EIS needs to contain an analysis that considers the environmental effects of the cooling-water discharge system and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental benefits of the proposed action. Adhering to the acceptance criteria listed above will help ensure that the environmental impacts of the cooling-water discharge system will be considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

Regulation of impacts from cooling system discharges is accomplished via the NPDES permit system administered by the EPA and the permitting States under Sections 316(a) and 402 of the CWA. The CWA requires that discharge system operation must ensure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving water body. Responsibility for making this determination (or for reassigning the responsibility) rests with the EPA.

Discharge system impacts on aquatic biota may result from the effects of thermal, chemical, and physical alterations to the receiving water body. Major alterations are usually confined to a limited discharge area

(the mixing zone), whereas lesser alterations may extend over a larger portion of the receiving-water body. Adverse effects on biota that are transported through, migrate through, or are attracted to the mixing zone may be acute or chronic, and impacts may be reflected as changes in the populations of "important" species and in the structure and function of the ecosystem.

The reviewer should take the following steps to evaluate the impacts of the plant's discharge system:

(1) Determine whether the applicant has provided a current NPDES permit with a 316(a) determination (if required) or equivalent State permits and supporting documentation. If these documents are not available, are not current, or do not reflect conditions during the license-renewal term, continue the analysis at Step (2). Otherwise, prepare a statement for the SEIS describing the potential for discharge impacts to aquatic biota at the site that

- summarizes the permitting documents reviewed
- states that the required current NPDES permit and 316(a) determination are available and current
- concludes that there are no discharge impacts to aquatic organisms that may occur as a result of plant-cooling-system discharges to receiving water bodies.

(2) If "important" aquatic species are present and are susceptible to heat shock resulting from plant-cooling-system discharges to the receiving water bodies such that the effects will be detectable or may destabilize or noticeably alter population levels, then continue the analysis at Step (3). Otherwise, prepare a statement for the SEIS describing the potential for thermal impacts to aquatic biota at the site that

- summarizes the permitting information, species data, and methods for quantifying thermal stresses due to heat shock to aquatic biota that have been reviewed
- states that there are no populations of "important" aquatic biota present in the vicinity of the site that will be adversely affected by plant-cooling-system thermal discharges to the point where changes in their population levels are detectable
- concludes that, because aquatic biota populations will remain stable even if some are affected by heat shock, the cooling-system discharge impacts on aquatic biota are SMALL within the context of the analysis in NUREG-1437 and that mitigation is not warranted.

(3) Determine and assess the levels of potential biological impacts.

- Consider the biological effects of thermal, chemical, and physical alterations to the receiving water body on the identified "important" aquatic species, including combined effects (e.g., thermal plus chemical effects) and the potential for gas-bubble disease.

- Give particular attention to the relationship of these stresses to life history requirements (e.g., growth, reproduction, migration).

- Evaluate the discharge system impacts of the plant as described below.

Procedures for reviewing specific impacts of thermal, chemical, and physical alterations are listed below. Analyze the impacts for the parameter when considered alone and the impacts for the parameter when combined with other parameters. The review should be based on general habitat types such as

- rivers and streams
- lakes and reservoirs
- estuaries
- seacoast.

Thermal Effects

The reviewer should consider species in the vicinity of the station and their susceptibility to thermal effects.

(1) Consider the following:

- maximum sustained temperatures for each season that are consistent with maintaining desirable levels of productivity

- maximum levels of metabolic acclimation to warm temperatures that will permit return to ambient winter temperatures if artificial sources of heat cease

- temperature limitations for survival of brief exposures to temperature extremes, both upper and lower

- if spawning or nursery areas are affected, restricted temperature ranges for various stages of reproduction, including (for fish) gonad growth and gamete maturation, spawning migration, release of gamete, development of the embryo metamorphosis, emergence, and other activities of early life stages, such as commencement of independent feeding by juveniles, and temperature required

- thermal limits for diverse compositions of species of aquatic communities, particularly where nuisance growths of certain organisms create reduction in diversity or where important food sources or chains are altered

- thermal requirements of downstream aquatic life where upstream warming of a cold-water source will adversely affect downstream temperature requirements

- areal extent of the plume
- percent of unaffected area
- physical concentrating factors.

(2) Identify the most thermally intolerant "important" species expected to be affected.

(3) Quantify the magnitude of potential thermal impacts to the aquatic ecosystem.

(4) Evaluation of thermal impacts, addressing the following recommendations:

- Growth of aquatic species should be maintained at levels necessary for sustaining actively growing and reproducing populations if the maximum weekly average temperature in the zone inhabited by the species at that time does not exceed one-third the range between the optimum temperature and the ultimate upper incipient lethal temperature of the species, and the temperatures above the weekly average do not exceed the criterion for short term exposures.

- After the specific limiting temperatures and exposure times have been determined by studies tailored to local conditions, the reproductive activity of selected species should be protected in those areas in which (1) temperature regimes required for gonad growth and maturation are preserved, (2) no temperature differentials are created that block spawning migrations, although some delay or advancement of timing based upon local conditions may be tolerated, (3) temperatures are not raised to a level at which necessary spawning or incubation temperatures of winter spawning species cannot occur, (4) sharp temperature changes are not induced in spawning areas, either in mixing zones or in mixed water bodies (the thermal and geographic limits to such changes will be dependent upon local requirements of species, including spawning microhabitat, e.g., bottom gravels, littoral zone, and surface strata), (5) timing of reproductive events is not altered to the extent that synchrony is broken where reproduction or rearing of certain life stages is shown to be dependent upon cyclic food sources or other factors at remote locations, and (6) normal patterns of gradual temperature changes throughout the year are maintained.

- Nuisance growths of organisms may develop where there are increases in temperature or alterations of the temporal or spatial distribution of heat in either the receiving water bodies (e.g., rivers, lakes) or in onsite cooling ponds. Some nuisance conditions may be created by operation of cooling ponds that may not affect receiving water body biota, but that may affect the aesthetic quality of the site and vicinity. The reviewer should consider such factors (e.g., odors from algal or macrophyte growth and decomposition) in making this evaluation. There should be careful evaluation of all factors contributing to nuisance growths at any site before establishment of thermal limits based upon this response, and temperature limits should be set in conjunction with restrictions on certain other factors (e.g., eutrophication).

Chemical Effects

The reviewer should consider species in the vicinity of the station and their susceptibility to chemicals released.

(1) Consider the following parameters:

- acute toxicity
- chronic toxicity
- accumulation
- biomagnification
- sublethal and behavioral effects.

(2) Determine if applicant needs to perform bioassays for important chemicals such as copper, chlorine, or related components, and scale inhibitors based on site-specific conditions.

(3) Compare the concentrations of chemicals at the discharge points with concentrations of the same chemicals in ambient waters.

- Consider dilution and mixing of chemical discharges.
- Obtain estimates of concentrations at various distances from the release point.
- Assess the effects of variable environmental and plant operation conditions on injury or mortality of suspectable organisms.
- Determine the potential for bioconcentration, biomagnification, and interacting effects for certain chemicals.

(4) Determine the biological losses from chemical stress based upon

- plume configuration
- time and concentration
- worst and average conditions.

(5) Determine if losses of either resident or migratory species will occur given proposed specifications for chemical releases.

(6) Evaluations of chemical impacts should address the following:

- the possible environmental effect of certain chemicals, like chlorine (hypochlorite), chlorination byproducts, other biocides, and scale and corrosion inhibitors

- alternatives to the biocide treatment of condenser tubing.

Physical Effects

The reviewer should consider species in the vicinity of the station and their susceptibility to physical effects.

(1) Consider the following parameters:

- reduction in density, species composition, and community structure of the benthos
- loss or alteration of habitat
- alteration of migratory pathways.

(2) Consider the potential effects of the following on habitat loss and species composition

- altered current patterns
- current velocity
- littoral drift
- scouring
- siltation
- increased turbidity
- gas supersaturation (gas-bubble disease)
- low dissolved oxygen
- predation
- parasitism
- disease among organisms exposed to sublethal stresses.

(3) Note effects associated with loss or alteration of habitat and the resultant potential reduction in species composition and community structure.

(4) Evaluation of physical impacts should address the following:

- potential loss or alteration of unique habitat
- potential effects of altered migratory pathways
- potential effects of other biotic changes.

IV. EVALUATION FINDINGS

Input to the EIS should (1) a list of adverse impacts of cooling system discharge operation to aquatic ecosystems, (2) a list of impacts for which there are measures or controls to limit adverse impacts and the associated measures and controls, (3) the applicant's commitments to limit these impacts, and (4) the staff's evaluation of the adequacy of the applicant's measures and controls to limit adverse impacts. This information will be summarized by the reviewer of ESRP 5.10.

The staff's analysis may be provided by referencing the aquatic biota descriptions of ESRP 2.4.2 and describing in brief detail the effects on biota that are "important" and susceptible to thermal, chemical, or physical impact. Types, life stages, and relative abundance of impacted "important" biota should be described, along with specific aspects of the proposed discharge-system operation responsible for impacts on these biota. This section should contain estimates of survival from these discharge system impacts and estimates of the relative or absolute losses of the impacted populations. Documentation of informal or formal consultations under Section 7 of the ESA that took place with the appropriate regional offices of the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service, or with appropriate State agencies or affected Native American tribes to determine the extent of potential impacts on aquatic species on and in the vicinity of the site should be included in the EIS.

Staff conclusions should evaluate the significance of losses to the populations of "important" species, including a determination of whether these losses will constitute an adverse impact that should be mitigated or avoided. Any studies or environmental investigations that address discharge system impacts should be described or referenced. The reviewer should ensure that measures and controls to limit or avoid impacts are consistent with the NPDES permit, if available.

If the reviewer verifies that sufficient information has been provided in accordance with the guidelines of this ESRP section, then the evaluation supports the following types of concluding statements to be included in the staff's EIS:

> The staff reviewed the available information relative to impacts to the aquatic environment on or in the vicinity of the site. The staff concludes that the list and description of impacts is adequate to comply with 10 CFR 51.45.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

10 CFR 51.95, "Supplement to the final environmental impact statement."

10 CFR 52, Subpart A, "Early Site Permits."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 423, "Steam Electric Power Generating Point Source Category."

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Marine Mammal Protection Act of 1972, Pub. L.92-527, Oct. 21, 1972, 86 Stat. 1027, as amended, 16 USC 1361 et seq.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

Memorandum of Understanding between the Corps of Engineers, U.S. Army, and the U.S. Nuclear Regulatory Commission for the Regulation of Nuclear Power Plants. 40 *Federal Register* 37110 (August 25, 1975).

Rivers and Harbor Appropriation Act, as amended, 33 USC 401, et seq.

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5.3.3 HEAT-DISCHARGE SYSTEM

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the impacts of the heat-discharge system during station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.3.3.1 and 5.3.3.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS or supplement from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's heat-discharge system is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.3.3.1 and 5.3.3.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.3.3.1 HEAT DISSIPATION TO THE ATMOSPHERE

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's consideration of vapor plumes from heat-dissipation systems that may have physical or aesthetic impacts due to the increased moisture and chemical content of the air, the nature and extent of these increases, and the significance of their potential environmental impacts to man's activities in the site vicinity. If a potential impact is judged to be significant, this plan should provide a basis for evaluating appropriate mitigation measures or alternative heat-transfer-system designs.

The scope of the review directed by this plan should include prediction and assessment of the following:

- length and frequency of elevated plumes
- frequency and extent of ground level fogging and icing in the site vicinity
- solids deposition (e.g., drift deposition) in the site vicinity
- cloud formation, cloud shadowing, and additional precipitation
- interaction of the vapor plume with existing pollutant sources located within 2 km of the plant
- ground level humidity increase in the site vicinity.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 1.2. If a natural draft cooling tower is used for heat dissipation, then obtain information as to whether the applicant has obtained FAA approval for construction of the tower if it extends more than 60.96 m (200 ft) above ground level.

- ESRPs 2.2.1, 2.5.3, and 3.1. Provide a choice of locations for which cooling system impact analyses should be performed.

- ESRP 2.7. Obtain appropriate meteorological data for evaluating cooling system impacts.

- ESRP 3.4. Obtain a description of the cooling system.

- ESRPs 5.1.1, 5.1.3, 5.2.2, 5.3.3.2 and 5.8.1. Provide a description of the heat dissipation system, including effluent quantities and visual impacts, in sufficient detail to permit the assessment of their effects on the terrestrial ecosystem and socioeconomic concerns.

- ESRP 5.10. Provide a summary of the recommended measures and controls required to limit adverse impacts of operating the heat dissipation system.

- ESRPs 9.4.1 and 9.4.2. Provide a list of adverse heat dissipation or cooling water system impacts that could be avoided through alternative heat dissipation system design or operational procedures, and assist in identifying appropriate alternatives.

- ESRP 10.1. Provide a summary of any unavoidable adverse impacts resulting from operation of the heat dissipation system, including a description of the significance of the losses.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following cooling tower data or information should be obtained:

- physical characteristics (from the environmental report [ER]) including

  - principal physical dimensions, including exit diameter
  - elevation of all tower bases above sea level
  - height of the tower
  - number of fans (for mechanical draft) and, if reversible, schedule of operation in cold weather.

- estimated performance characteristics (for design and off-design) (from the ER) including

  - air and water mass flow rates at tower emission point
  - efflux speed
  - temperature of water entering and leaving the tower
  - temperature of air leaving the tower
  - amount of heat released
  - performance curves (supplied by the tower vendor).

- estimated drift characteristics (from the ER) including

  - drift rate for both design and off-design weather conditions, at full load
  - expected size distribution of drift droplets (from the general literature)
  - concentration of dissolved and suspended solids in tower basin.

- onsite meteorological data (from ESRP 2.7)

- predicted chemical interaction of the cooling tower plume(s) with existing pollutant sources located within 2 km of the plant (from the ER).

Data and information on cooling lakes and canals or spray canals, including monthly and annual joint-frequency distribution tables of wind speed, wind direction, and atmospheric stability based on onsite data (from ESRP 2.7) should be obtained.

Cooling-system effects information to be obtained include the following:

- a description of or reference to the applicant's analytical technique for determining cooling system operational characteristics (from the ER)

- predictions of the following cooling system effects at site and vicinity locations (e.g., agricultural areas, residential areas, highways, and station facilities) described in ESRPs 2.2.1, 2.5.3, and 3.1 (from the ER):

  - annual plus seasonal and/or monthly elevated plume lengths
  - annual plus seasonal and/or monthly amounts of salt deposition
  - annual plus seasonal and/or monthly additional hours of fogging and icing
  - potential weather modification in terms of cloud formation and shadowing
  - annual plus seasonal and/or monthly increases in humidity.

Data and information on similar heat dissipation systems, including operating experience for similar heat dissipation systems located within 50 km (31 mi) of the site (from the ER and the general literature) or from systems having generally similar climate and meteorology (from the general literature) should be obtained.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the impacts of heat dissipation on the atmosphere are based on the relevant requirements of the following:

- 10 CFR 51.71(d) with respect to the review of environmental issues associated with heat dissipation to the atmosphere
- 10 CFR 51.95 with respect to the post construction review of environmental issues associated with heat dissipation to the atmosphere
- 10 CFR 52.18 with respect to review of environmental issues associated with heat dissipation to the atmosphere for early site permits
- 10 CFR 52.89 with respect to review of environmental issues associated with heat dissipation to the atmosphere for combined licenses.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- The reviewer should ensure that heat dissipation system impacts have been identified and described in sufficient detail to enable the reviewers for ESRPs 5.3.3.2 and 5.8.2 to evaluate and assess the environmental effects resulting from heat dissipation system. The reviewers for these plans should be consulted as part of this evaluation.
- The staff used operational data to review several potential environmental impacts associated with cooling systems. The results of these reviews are presented in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NRC 1996), and codified for use in environmental reviews associated with license renewal in 10 CFR 51.

Technical Rationale

The technical rationale for evaluating applicant's impacts from heat dissipation to the atmosphere is discussed in the following paragraphs:

Compliance with sections of 10 CFR 51 and 52 involves staff identification and evaluation of the environmental effects of heat dissipation to the atmosphere. Factors that affect the potential environmental effects include cooling system type, design specifications, and climate.

The staff should determine applicability of the results of the generic environmental impact statement (GEIS) (NRC 1996) reviews of operational data to evaluation of impacts associated with heat dissipation to the atmosphere in environmental reviews by comparing the applicant's plant design

and/or site environment with the ranges of designs and environments considered in the GEIS. The level of staff review of site/design specific data should be determined on the basis of the applicability of the conclusions in the GEIS and the conclusions reached in the GEIS.

III. REVIEW PROCEDURES

The reviewer should analyze the applicant's estimates of the atmospheric effects of cooling system operation. The reviewer should consult with the reviewers for ESRPs 2.2.1, 2.5.3, and 3.1 to determine those locations for which analyses should be performed.

(1) Evaluate the potential impacts on transportation caused by fogging and icing on the basis of the predicted additional hours of fogging and icing resulting from heat dissipation system.

- When these additional hours represent a significant fraction of the naturally occurring hours (determined by the reviewer for ESRP 2.7), and the affected transportation routes will be used by the general public, identify and evaluate means to mitigate the impact.

(2) Compare predictions of the occurrence of plume interaction with

- existing pollutant sources
- weather modification in terms of cloud development
- shadowing
- humidity increases
- increased precipitation due to cooling tower plume or drift with operating experience at other sites.

(3) Evaluate unusual heat dissipation system impacts (e.g., drift deposition on switch yards and other structures) not considered by the reviewers for ESRPs 5.1.1, 5.1.3, 5.3.3.2, and 5.8.1, and identify and evaluate means to avoid or mitigate any such impacts that are sufficiently adverse to warrant this action.

(4) For spray canals, existing literature values for drift deposition rates may be used. Drift from a cooling pond or lake need not be considered.

(5) Use the following references to find appropriate models for conducting any additional analyses needed:

- See Hanna et al. (1982) and Hanna (1984) for information on the atmospheric impacts of heat dissipation.

- See Carhart et al. (1982) for an evaluation of models that predict the rise and length of plumes from natural draft cooling towers. The best models of the period predict the visible plume rise within a factor of 2 and plume length within a factor of 2.5 about 50% of the time.

- See Carhart and Policastro (1991) for a more recent model for natural draft and mechanical cooling towers that predicts the plume rise within a factor of 2 about 75% of the time and visible plume length within a factor of 2.5 about 70% of the time.

- See Carhart et al. (1992) for the use of this model in predicting the long shadowing and resultant decrease in solar radiation caused by cooling tower plumes.

- See Policastro et al. (1994), which extends the description to use of the model for estimating seasonal and annual cooling tower impacts, including drift deposition, icing, and fogging.

(6) Perform independent analysis of additional hours of ground level fogging, icing, drift, humidity increase, and deposition of pollutants generated by offsite sources.

- The need for this analysis will depend on the level of the potential impact, the level of confidence in the applicant's model, and the extent, applicability, and representative nature of the available meteorological data and observational experience at operating stations.

- Coordinate this analysis with the reviewers for ESRPs 5.1.1, 5.1.3, 5.3.3.2, and 5.8.1 to ensure that appropriate heat dissipation system factors are considered and to avoid duplication of any environmental analyses.

(7) For an independent analysis, use the following procedure:

- For towers, use hourly onsite meteorological data, tower performance specifications, and an appropriate model to generate information on the spatial distribution of the elevated plume, annual plus seasonal and/or monthly estimates of ground level fogging, icing, and drift deposition as a function of distance and direction from the tower. These data should be compared with the meteorological data provided by the reviewer for ESRP 2.7 to determine the additional amount of ground level fogging and icing and to calculate the amount of drift deposition for the appropriate site-vicinity locations.

- For cooling systems employing spray canals or a cooling pond, assume the following:

  - The plume will exist as ground level fog, but will evaporate within 300 m or lift to become stratus for wind speeds greater than 2.2 m/sec.

  - The plume will exist as fog over the pond, lifting to become stratus for winds less than or equal to 2.2 m/sec.

IV. EVALUATION FINDINGS

Input to the EIS should contain the following information:

- reference to the ESRP 3.4 description of the applicant's proposed heat dissipation system, including a statement to locate the system on the station site and its distance from site and vicinity locations that could be affected by heat dissipation system operation

- predictions of the following for the affected site and vicinity locations:

  - additional amount of ground level fogging and icing
  - annual and/or monthly amount of drift deposition in gm/m^2 or drift concentration in mg/m^3
  - cloud development and cloud shadowing
  - weather modification in terms of increased precipitation
  - humidity increase
  - interaction of the heat dissipation system plume with existing pollutants.

  Predictions should be compared with recorded climatological data and observations from operating sites with similar climatological features.

Evaluation of each identified impact should result in one of the following determinations:

- *The impact is minor, and mitigation is not required.* When all impacts are of this nature, the reviewer should include a statement in the EIS of the following type:

  > The staff reviewed the available information on heat dissipation to the atmosphere from cooling system operation. Based on this review, the staff concludes that there are no significant environmental impacts.

- *The impact is adverse, but can be mitigated by design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the Environmental Project Manager and the reviewer for ESRP 9.3.1 for verification that the reviewer's modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications and measures and controls to limit the corresponding impact. These lists should be provided to the reviewer for ESRP 5.10.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the reviewer for ESRP 9.3.1 that an evaluation of alternative designs or procedures is required. The reviewer should participate in any such evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should provide this information to the reviewer for ESRP 10.1.

If the staff relies on findings in the GEIS, appropriate statements of the following type should be included in the EIS:

The staff finds that the cooling system design and the environment in the vicinity of the site are within the ranges of designs and environments evaluated in the GEIS (NRC 1996) and that there are no apparent special circumstances of the site or design that would invalidate the generic conclusions related to environmental effects of heat dissipation to the atmosphere in the GEIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

10 CFR 52.18, "Standards for review of applications."

10 CFR 52.89, "Environmental review."

Carhart, R.A., A.J. Policastro, and S. Ziemer. 1982. "Evaluation of mathematical models for natural-draft cooling-tower plume dispersion." *Atmospheric Environment* 16(1):67-83.

Carhart, R.A. and A.J. Policastro. 1991. "A second-generation model for cooling tower plume rise and dispersion—I. Single sources." *Atmospheric Environment* 25A(8):1559-1576.

Carhart, R.A., A.J. Policastro, and W.E. Dunn. 1992. "An improved method for predicting seasonal and annual shadowing from cooling tower plumes." *Atmospheric Environment* 26A(15):2845-2852.

Hanna, S.R., G.A. Briggs, and R.P. Hosker, Jr. 1982. *Handbook on Atmospheric Diffusion*. DOE/TIC-11223, U.S. Department of Energy, Washington, D.C.

Hanna, S.R. 1984. "Atmospheric Effects of Energy Generation." In *Atmospheric Science and Power Production*. D. Randerson, ed. DOE/TIC-27601, U.S. Department of Energy, Washington, D.C.

Policastro, A.J., W.E. Dunn, and R.A. Carhart. 1994. "A Model for Seasonal and Annual Cooling Tower Impacts." *Atmospheric Environment* 28(3):379-395.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Washington, D.C.

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5.3.3.2 TERRESTRIAL ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and evaluation of impacts to terrestrial ecosystems induced by the operation of heat dissipation systems, especially cooling towers and cooling ponds. The scope of the review directed by this plan will be limited to consideration of the operational aspects of heat dissipation systems in sufficient detail to form a basis for assessing potential operational impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.4.1. Obtain descriptive material on the terrestrial ecology of the site and vicinity to support the analyses made in ESRP 5.3.3.2.
- ESRP 3.4.2. Obtain specific information about the cooling system necessary to assess impacts to the terrestrial environment.
- ESRP 5.3.3.1. Obtain information about heat dissipation to the atmosphere necessary to determine impacts to the terrestrial environment.

- ESRP 5.10. Provide a list of measures and controls to limit adverse impacts to terrestrial biota that are to be evaluated in regard to the licensing process and a list of applicant commitments to limit these impacts.

- ESRP 6.5.1. If potential adverse impacts due to heat-dissipation are predicted, then provide preoperational baseline monitoring program elements.

- ESRP 9.4.1. Provide a list of adverse environmental impacts that could be mitigated or avoided through use of alternative heat dissipation system designs or operational procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable impacts to terrestrial ecosystems that are predicted to occur as a result of operation of heat-dissipation systems.

- ESRP 10.2. Provide a summary of irreversible and irretrievable commitments of terrestrial biota that are predicted to occur as a result of the operation of heat-dissipation systems.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- concentration and chemical composition of dissolved and suspended solids in cooling tower basins or spray canals on a seasonal basis (from ESRP 3.4.2)

- isopleths of deposition at ground levels on a seasonal basis. Isopleths should extend to values at least as low as 1 kg/ha/mo (from the environmental report [ER] and ESRP 5.3.3.1).

- a list and description of the "important" terrestrial species and habitats that may be affected by the heat-dissipation system (from ESRP 2.4.1)

- descriptions of natural and managed plant communities on the site and within offsite isopleths above 20 kg/ha/yr (from ESRPs 2.4.1, 5.3.3.1, and the site visit)

- annual precipitation and its dissolved solid concentration within the drift field (from the ER)

- prediction of increased frequency and distribution of fog and icing (from ESRP 5.3.3.1)

- shoreline vegetation expected to develop along the shore of new cooling lakes and ponds (from the ER and consultation with Federal, State, and local agencies)

- proposed other uses of cooling ponds and reservoirs (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of impacts on terrestrial ecosystems from the heat dissipation system are based on the relevant requirements of the following:

- 10 CFR 51.45 with respect to ERs and the analysis of potential impacts contained therein
- 10 CFR 51.75 with respect to analysis of impacts on the terrestrial environment affected by the issuance of a construction permit
- 10 CFR 52, Subpart A, with respect to analysis of impacts on the terrestrial environment affected by the issuance of an early site permit
- 10 CFR 51.95 with respect to the preparation of supplemental environmental impact statements (EISs) in support of the issuance of an operating license
- Endangered Species Act of 1973, as amended, with respect to identifying threatened or endangered species and critical habitats and formal or informal consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service
- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources and the planning of development projects that affect water resources

Regulatory guidelines and specific criteria to meet the regulations and identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance for the preparation of ERs. With respect to the heat-dissipation system, it specifies that detailed descriptions of the expected effects of the system on the local environment with respect to fog, icing, precipitation modifications, humidity changes, cooling-tower blowdown and drift, and noise should be included in the ER. The reviewer should ensure that the appropriate data and analyses are provided in the ER.
- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998), contains guidance on factors that should be considered in the site-selection process. In specific regard to cooling-tower drift, this guide states "The potential loss of important terrestrial species and other resources should be considered."
- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (NRC 1977), contains technical information for the design and execution of terrestrial environmental studies, the results of which may be appropriate for inclusion in the applicant's ER. The reviewer should ensure that the appropriate results concerning potential effects of the heat-dissipation system on the terrestrial environment are included in the ER.

Technical Rationale

The technical rationale for evaluating the applicant's impacts from heat-dissipation systems to terrestrial ecosystems is discussed in the following paragraph:

> The EIS needs to include the results of an analysis that considers the environmental effects of the proposed heat dissipation system and the alternatives available for reducing or avoiding adverse environmental effects. Any environmental benefits that may result from the operation of the heat dissipation system should also be included. Following the acceptance criteria listed above will help ensure that the environmental impacts of the proposed heat-dissipation system are considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

The depth and extent of the input to the EIS will be governed by the environmental characteristics of the terrestrial ecology that could be affected by operation of the station's heat dissipation systems and by the magnitude of the expected impacts to the terrestrial environment.

The most apparent effects of heat dissipation systems on terrestrial ecosystems are those associated with cooling-tower or spray pond operation. These include the effects of vapor plumes, icing, and salt drift on the terrestrial ecosystems. The potential for bird collision with cooling towers should be addressed by the reviewer for ESRP 4.3.1. To date, at stations using once through cooling systems, no adverse impacts to terrestrial ecosystems have occurred that require mitigating actions. In circumstances where once through cooling is proposed, the analysis may terminate without further consideration unless unusual environmental circumstances make more analysis necessary.

(1) Consider the impacts of drift deposition on plants.

- Drift deposition has the potential for adversely affecting plants, but the tolerance levels of native plants, ornamentals, and crops are not known with precision.
- General guidelines for predicting effects of drift deposition on plants suggest that many species have thresholds for visible leaf damage in the range of 10 to 20 kg/ha/mo of NaCl deposited on leaves during the growing season.
- These effects can be altered by the frequency of rainfall, humidity, type of salt, and sensitivity of species.
- Use maps of the site and vicinity showing drift isopleths that were produced by recognized drift-dispersion models to define areas of possible botanical injury.

- Use an order-of-magnitude approach, as follows, to analyze operational impacts from salt drift:

  - Deposition of salt drift (NaCl) at rates of 1 to 2 kg/ha/mo is generally not damaging to plants.

  - Deposition rates approaching or exceeding 10 kg/ha/mo in any month during the growing season could cause leaf damage in many species.

  - Deposition rates of hundreds or thousands of kg/ha/yr could cause damage sufficient to suggest the need for changes of tower-basin salinities or a reevaluation of tower design, depending on the amount of land impacted and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

(2) Consider the detrimental effects increased fogging could have on local vegetation if the increase in humidity induces an increase in fungal or other phytopathological infections. Increased icing can cause physical damage to vegetation due to increased structural pressure on tree branches or by damaging fruit or leaf buds.

- Use an order of magnitude approach as follows to analyze operational impacts from fog or ice:

  - Fogging or icing of vegetation on the order of a few hours per year is generally not severe.

  - Fogging or icing on the order of tens of hours per year may cause detectable damage to vegetation.

  - Fogging or icing occurring for hundreds of hours per year could be severe enough to suggest the need for design changes, depending on the amount of land impacted and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

- Consider soil salinization:

  - The risk from this source is generally considered to be low.

  - In arid areas (deserts), salts could accumulate in soils over long time intervals and cause damage.

(3) Consider the impact to terrestrial biota when new shoreline habitats are created along ponds and reservoirs built for cooling purposes. Riparian tree/shrub communities that form around these new ponds or reservoirs may attract "important" species.

If endangered or threatened species could be affected, agency level formal or informal consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act is required.

IV. EVALUATION FINDINGS

Input to the EIS should accomplish the following objectives: (1) public disclosure of any expected impact to the terrestrial ecosystem as a result of the operation of the heat dissipation system, (2) presentation of the basis of staff analysis of the project, and (3) presentation of staff conclusions, evaluations, and conditions regarding terrestrial ecosystems. These conclusions should include

- a list of adverse impacts of cooling-system heat dissipation to terrestrial ecosystems
- a list of the impacts for which there are measures or controls to limit adverse impacts and associated measures and controls
- the applicant's commitments to limit these impacts
- the staff's evaluation of the adequacy of the applicant's measures and controls to limit adverse impacts.

This information should be summarized by the reviewer for ESRP 5.10.

Evaluation of impacts should result in one of the following conclusions:

- *The impact is minor, and mitigation is not warranted.* If the degree of impact falls into the first order category (a few hours of icing or fogging each year or a few kilograms of salt drift per hectare per year), the reviewer may conclude that these impacts are not of sufficient magnitude to warrant further evaluation.
- *The impact is adverse, but can be mitigated by design and procedure modifications.* If the degree of impact falls within the second-order category (a few tens of hours per year increase in fog or ice or a few tens of kilograms of salt drift deposition per hectare per year), the reviewer may conclude that the effects are adverse and that mitigating actions should be considered. For these cases, the reviewer should consult with the Environmental Project Manager (EPM) and the reviewer for ESRP 9.4.1 for verification that the modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications and measures and controls to limit the corresponding impact. These lists should be given to the reviewer for ESRP 5.10.
- *The impact is adverse and is of such magnitude that it should be avoided, if it cannot be mitigated.* If the degree of expected impacts falls within the third order category (hundreds of hours of increase in fog and ice or hundreds of kilograms of salt drift per hectare per year), the reviewer may conclude that the impacts of operation are sufficiently adverse that consideration of alternative designs or locations to avoid the impact is warranted. When impacts of this nature are identified, the reviewer should inform the EPM and the reviewer for ESRP 9.4.1 that an analysis and evaluation of alternative designs or procedures is needed. The reviewer should participate in any such analysis and

evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should provide this conclusion to the reviewer for ESRP 10.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, Subpart A, "Early Site Permits."

Endangered Species Act, as amended, 16 USC 1531 et seq.

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Terrestrial Environmental Studies for Nuclear Power Stations*. Regulatory Guide 4.11, Rev. 1, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2, Washington, D. C.

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5.3.4 IMPACTS TO MEMBERS OF THE PUBLIC

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's evaluation of the human health impacts associated with the plant's cooling system. This includes impacts from thermophilic microorganisms and from noise resulting from the operation of the cooling system.

The scope of this ESRP section includes (1) background information on thermophilic microorganisms that could negatively affect human health, (2) methods for evaluating the potential for an increase in the numbers of thermophilic microorganisms as a result of thermal discharges, and (3) the potential for noise resulting from the plant's cooling system. Noises that are generated by the plant's paging system or from transmission wires and associated substations are addressed in ESRP 5.6.3 and are not discussed further in this section.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 3.4.1 and 3.4.2. Obtain a description of the cooling system and its operational modes, a description of the location of thermal discharges for the plant, and estimated noise levels.

- ESRP 5.3.2.1. Obtain an indication of the temperature increases expected for the aquatic environments that are subject to the plant's thermal discharges.

- ESRP 5.10. Provide any mitigation measures that should be employed to (1) minimize potential impacts caused by increased numbers of deleterious thermophilic microorganisms as a result of thermal discharges and (2) minimize potentially unacceptable noise levels resulting from operation of the cooling system.

Data and Informational Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- thermophilic microorganisms

  - a description of the location of the thermal discharges for the plant's cooling system (i.e., a cooling pond, lake, canal, small river, large river, or ocean) (from ER or ESRP 3.4.1)

  - the temperature increase expected for the aquatic environment that is subject to the plant's thermal discharges (from ER or ESRP 5.3.2.1)

  - the results of any analyses that have been made for the presence of deleterious thermophilic microorganisms. These include the enteric pathogens, *Salmonella* sp. and *Shigella* sp., as well as *Pseudomonas aeriginosa* and thermophilic fungi. In addition, analyses for the presence of unusually high concentrations of the normally present *Legionella* sp. (Legionnaires' disease bacteria) and the free-living amoebae of the genera *Naegleria* and *Acanthoamoeba* should be cited (from the ER or the applicant.)

  - a list of the outbreaks of waterborne diseases in the United States during the previous 10 years in the vicinity of the plant. This list is published regularly by the Centers for Disease Control and Prevention and can be obtained from the Centers for Disease Control and Prevention or from (CDC 1996) Geographical, Environmental, & Siting Information System (GEn&SIS).

  - an evaluation of any available data concerning the occurrence and concentrations in the vicinity of the plant of any of the deleterious thermophilic microorganisms listed above and a determination of whether any of them are present under conditions and in locations that might be harmful to members of the public who come in contact with them. If such an evaluation exists, it may be obtained from the applicant or from the State Public Health Department in the State in which the plant is being constructed.

- noise

  - the type of cooling system, specifically, whether the plant has cooling towers and whether they are natural draft or mechanical draft (from ER or ESRP 3.4.2)

- the distance to the nearest offsite residence and to the site boundary (from the reviewer of ER or ESRP 2.5.1).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the analysis and evaluation of the nonradiological health impacts of the cooling system on humans are based on the following:

- None

Regulatory positions and specific criteria are as follows:

- The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437) (NRC 1996) contains an analysis of the effects of cooling system discharges on thermophilic microorganisms that have the potential to adversely affect human health. This analysis can provide guidance to the staff in determining the significance of the potential effects of these discharges and the depth of the analysis required.

Technical Rationale

The technical rationale for evaluating the applicant's description of nonradiological health impacts of the cooling system on humans is discussed in the following paragraphs for both thermophilic microorganisms and for noise:

Thermophilic Microorganisms—Microorganisms that are associated with cooling towers and thermal discharges can have negative impacts on human health. The presence and numbers of these organisms can be increased by the addition of heat; thus they are called thermophilic organisms. These microorganisms include the enteric pathogens *Salmonella* sp. and *Shigella* sp. as well as *Pseudomonas aeruginosa* and thermophilic fungi. They also include the bacteria *Legionella* sp., which causes Legionnaires' disease, and free-living amoebae of the genera *Naegleria* and *Acanthamoeba*. Exposure to these microorganisms, or in some cases the endotoxins or exotoxins produced by the organisms, can cause illness or death.

40 CFR 141.70 regulates maximum contaminant levels of various microorganisms, including *Legionella* in public drinking water systems. However, there are no regulations that could be tied to microorganisms that are associated with cooling towers or thermal discharges. No Occupational Safety and Health Administration (OSHA) or other legal standards for exposure to microorganisms exist at the present time.

Noise—There are no Federal regulations for levels of noise for public exposures. When noise levels are below the levels that result in hearing loss, impacts have been judged primarily in terms of adverse public reactions to noise. The Department of Housing and Urban Development

(24 CFR 51.101(a)(8)) uses day-night average sound levels recommended by EPA as guidelines or goals for outdoors in residential areas. Noise levels are acceptable if the day-night average sound level outside a residence is less than 65 decibels.

III. REVIEW PROCEDURES

This procedure applies to the review of applications for construction permits, operating licenses, and combined licenses. The review procedures for impacts from microorganisms are discussed separately from the procedures for impacts from noise.

Thermophilic Microorganisms

Consideration of the impact of thermophilic microorganisms on the public health is important, especially for those plants using cooling ponds, lakes, canals, or small rivers because the operation of these plants may significantly increase the presence and numbers of thermophilic organisms. Additional information regarding these organisms can be found in the Appendix to this ESRP. The following review procedures should be used.

(1) If the plant does not use a cooling pond, lake, or canal or discharge to a small river, then conclude that there will not be a detrimental impact from the thermal discharges on the concentration levels of deleterious thermophilic microorganisms, and, therefore, further analysis is not necessary.

(2) If the plant uses a cooling pond, lake, or canal or discharges to a small river as described above, then further analysis of any available data would be appropriate, especially if the plant is located in the southern regions of the United States. At the minimum,

- Consult with the State Public Health Department.
- Review any records associated with waterborne disease outbreaks in the region.

(3) If it appears to be likely that thermal discharges from the plant would increase the number of deleterious thermophilic microorganisms to levels that could cause a public health problem, then request that the applicant consider mitigative measures to minimize the potential impacts.

- Mitigative measures may include
  - setting up and executing a monitoring program for deleterious thermophilic microorganisms
  - limiting public access to areas affected by the plant's thermal discharges (such as prohibiting public swimming in the mixing zone of the river)
  - the use of respirators by plant workers to protect against mists from cooling towers or dusts inhaled during cleaning processes.

- Analyze any mitigative measures and forward them to the reviewer for ESRP 5.10.

Noise

The authority for environmental noise control was given to the States in the 1972 Noise Control Act. When noise levels are below the levels that result in hearing loss, impacts have been judged primarily in terms of adverse public reactions to the noise. The principal sources of noise from plant operations include natural-draft and mechanical-draft cooling towers. Other occasional noise sources may include auxiliary equipment, such as pumps to supply cooling water from a remote reservoir. Generally, power-plant sites do not result in offsite noise levels greater than 10 dB(A) above background (NRC 1996). Noise level increases larger than 10 dB(A) would be expected to lead to interference with outdoor speech communication, particularly in rural areas or low-population areas where the day-night background noise level is in the range of 45-55 dB(A). Surveys around major sources of noise, such as major highways or airports, have found that when the day-night level increases beyond 60 to 65 dB(A), noise complaints increase significantly. Noise levels below 60 to 65 dB(A) are considered to be of small significance (NRC 1996).

(1) Become familiar with the applicable State noise limits for residential areas and other types of land use.

(2) Determine whether the plant has or will have cooling towers.

- If no cooling towers are anticipated, then the analysis is complete.

- If cooling towers are present, then compare the anticipated day night average level of noise determined at the site boundary (based on the dB(A-scale)) from the cooling towers with applicable State noise limits.

- If no State noise limits are available and if the day-night noise level is below 60 to 65 dB(A), then no further analysis is needed.

- If the noise levels exceed the State noise limits or in the absence of such limits if the day-night noise level exceeds 65 dB(A), then request that the applicant propose measures for mitigating the impact from the noise. Analyze these mitigation measures and forward them to the reviewer for ESRP 5.10.

IV. EVALUATION FINDINGS

Thermophilic Microorganisms

When the reviewer determines that the applicant's plant does not fall within the parameters discussed above (uses a cooling pond, lake, or canal or uses once-through cooling systems with discharges to other than small rivers), then the reviewer should provide a statement for the EIS similar to the following:

The applicant's plant utilizes a cooling system as described in ESRP 3.4.1. Because this system does not use a cooling pond, lake, or canal or discharge to a river with a flow rate below 9×10^{10} m^3/yr (3.15×10^{12} ft^3/yr), there is little potential for a detrimental increase in thermophilic microorganisms that would have a deleterious effect on public health (NUREG-1437). Therefore, no further analysis is necessary.

If the reviewer determines that the applicant's plant does fall within the parameters given above, i.e., uses a cooling pond, lake, or canal or uses once-through cooling with a discharge to a small river (9×10^{10} cubic meters per year [3.15×10^{12} cubic feet per year]), then the reviewer should

- Provide the results of the analyses and evaluation given above, including the results of the consultation with the State Public Health Department, related to any regional outbreaks of waterborne diseases.

- Discuss any mitigative measures that should be used to minimize negative human health impacts resulting from a potential increase in the levels of deleterious thermophilic microorganisms.

Noise

When the reviewer determines that the applicant's plant does not have mechanical or natural-draft cooling towers, then the reviewer should provide a statement for the EIS similar to the following:

The applicant's plant utilizes a cooling system as described in ESRPs 3.4.1 and 3.4.2 that does not depend on a cooling tower. Thus, the noise levels related to operation of the cooling tower are not pertinent to this plant.

When the reviewer determines that the applicant's plant does have natural or mechanical-draft cooling towers and has determined that the day-night noise level emanating from the towers during operation is below 65 dB(A) at the site boundary, then the reviewer should provide a statement for the EIS that is similar to the following:

The day-night noise levels that are anticipated from the plant's cooling tower are less than 65 dB(A) to the site boundary, which is considered to be of small significance to the public. Thus, no mitigation alternatives are necessary.

When the reviewer determines that the cooling towers from the applicant's plant will produce day-night noise levels above 65 dB(A) at the site boundary, the reviewer should describe the magnitude of the noise levels and the mitigative factors that will be employed.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

24 CFR 51, "Regulations Relating to Housing and Urban Development."

40 CFR 141.70, "General requirements."

Centers for Disease Control (CDC). 1996. *Surveillance for Waterborne-Disease Outbreaks—United States, 1993-1994.* M.H. Kramer, B.L. Herwaldt, G.F. Craun, R.L. Calderon, D.D. Juranek. Source: MMWR 45(SS-1):1-33. April 12, 1996.

Noise Control Act, as amended, 42 USC 4901 et seq.

U.S. Food and Drug Administration (FDA). 1996. *Foodborne Pathogenic Microorganisms and Natural Toxins 1992* (Bad Bug Book). Center for Food Safety & Applied Nutrition, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Vol. 1, Washington, D.C.

APPENDIX

Thermophilic Microorganisms - Background

Microorganisms that are associated with cooling towers and thermal discharges can impair human health. These microorganisms are called thermophilic organisms because their presence and numbers can be increased by the addition of heat.

The microorganisms *Salmonella* sp. and *Shigella* sp. are enteric pathogens. The methods of testing these microorganisms (as well as the microorganisms *Pseudomonas aeruginosa* and thermophilic fungi) are known, and their presence in aquatic environments can often be controlled. In addition, the inhalation or ingestion of small quantities of these organisms would not impair the health of individuals that are not immunosuppressed. However, the inhalation of endotoxins and exotoxins, which several of these organisms produce, may theoretically make healthy individuals sick, even though such illnesses have not been identified in power plant workers (NRC 1996).

Other microorganisms normally present in surface water, but not as easily controlled, include the bacteria *Legionella* sp., which causes Legionnaires' disease, and free-living amoebae of the genera *Naegleria* and *Acanthamoeba*. Some of the known cases of Legionellosis were traced to the aerosolization of waterborne *Legionella* sp. by cooling towers and evaporative condensers. *Legionella* is normally found in natural surface waters, and thus it is not surprising that they are found in even greater numbers in water from cooling towers and evaporative condensers. This type of equipment can amplify *Legionella* sp. concentrations and disperse the pathogen through aerosolization (NRC 1996).

Naegleria fowleri causes primary amoebic meningoencephalitis (PAM) and *Acanthamoebic keratitis* and *Acanthamoebic uveitis* cause granulomatious amoebic encephalitis (GAE). GAE is a particular risk for persons who are immunodeficient, although infections have occurred in otherwise healthy individuals (FDA 1996). The primary infection site is thought to be the lungs. The organisms that are in the brain are generally associated with blood vessels, suggesting vascular dissemination (FDA 1996). Only 100 to 200 reports of PAM have occurred worldwide (NRC 1996). Sources of infection for PAM generally include heated swimming pools, thermal springs, and a variety of naturally or artificially heated surface waters. During 1993 to 1994, only one case of PAM was reported by the Centers for Disease Control (CDC 1996). The one case was caused by *N. fowleri* and was associated with swimming in both a waste-water holding pond and in the Rio Grande River.

A study of cooling waters from 11 nuclear-power plants and associated control source waters indicated that only two sites were positive for the pathogenic *Naegleria fowleri*. In addition to testing for pathogenic amoebae in cooling waters, the 11 nuclear-power plants in the 1981 study were also studied for the presence of *Legionella* sp. In general, the artificially heated waters showed only a slight increase (i.e., $\leq$ 10-fold) in concentrations of *Legionella* sp. relative to source water. In a few cases, source waters had higher levels than did heated waters. Infectious *Legionella* sp. were found in 7 of 11 test waters and 5 of 11 source waters (NRC 1996).

An additional study of *Legionella* sp. presence in the environs of coal-fired electric power plants showed that *Legionella* was only infrequently found in locations that were not adjacent to cleaning operations. It was concluded that exposure to *Legionella* sp. from power-plant operations was a potential problem for part of the workforce, but that it would not be a public-health issue because concentrated aerosols of the bacteria would not traverse plant boundaries (NRC 1996).

Because the route of infection with *Naegleria* sp. is through inhalation, workers exposed to aerosols that could harbor this pathogen should have respiratory protection. Although the observed risk from *N. fowleri* is low, heavily used bodies of fresh water merit special attention and possibly routine monitoring for pathogenic *Naegleria* sp. Because *Naegleria* sp. concentrations in fresh water can be increased by thermal additions, nuclear power plants that utilize cooling lakes, canals, ponds, or small rivers may enhance the naturally occurring thermophilic organisms.

Although this issue is largely unstudied, the staff recognize a potential health problem stemming from heated effluents. Factors that affect the distribution of *Legionella* and the free-living pathogenic amoebae (including *Naegleria* sp.) are not well understood. Rapid tests for their detection and procedures for their control are not yet available. However, since Legionellosis is a respiratory disease and because the route of infection by *N. fowleri* is through the nasal passage, the use of appropriate respiratory protection is a necessity for controlling any potential exposure. Occupational health questions are currently resolved using proven industrial-hygiene principles to minimize worker exposures to these organisms in mists of cooling towers. Public-health questions require additional consideration, specifically for plants using cooling ponds, lakes, canals, or small rivers (having an average annual flow rate of less than 3.15×10^{12} cubic feet per year (9×10^{10} cubic meters per year) because the operation of these plants may significantly increase the presence and numbers of thermophilic organisms (NRC 1996).

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.4 RADIOLOGICAL IMPACTS OF NORMAL OPERATION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the radiological impacts of normal station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.4.1 through 5.4.4.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

Technical rationale for evaluating the applicant's description of radiological impacts of normal operation is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.4.1 through 5.4.4. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.4.1 EXPOSURE PATHWAYS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and description of the environmental pathways by which radiation and radioactive effluents can be transmitted from the proposed plant to living organisms. The scope of the review directed by this plan should include consideration of (1) the pathways by which gaseous and liquid radioactive effluents can be transported to individual receptors and (2) the location of these receptors. The scope should also include quantitative information on the production of major types of foods within 80 km (50 miles) of the plant and the expected consumption of these foods by the population projected to be living in this area 5 years from the date of the licensing action under consideration. The review should be sufficiently detailed to provide input to other reviews relating to radiation dose estimates, radiological impacts, and environmental monitoring and to permit the determination of individual and population doses and their comparison with the requirements of 10 CFR 20, "Standards for Protection Against Radiation," and 10 CFR 50.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.2. Obtain the present annual milk, meat, and vegetable production.

- ESRPs 2.3.1 and 2.3.2. Obtain the transit times and dilution factors at each appropriate receptor location and transit times to unrestricted area boundaries and diluted stream flows at these boundaries.

- ESRP 2.5.1. Obtain the population distribution data for the year of interest.

- ESRP 2.7. Obtain the atmospheric transport and diffusion calculations at each receptor location.

- ESRP 3.5. Obtain the effluent release points for liquid and airborne releases. The reviewer should also verify the sources of direct radiation of onsite out-of-plant waste. Note: This interface does not apply for early site permit applications.

- ESRP 4.5. Obtain the construction work force collective annual dose.

- ESRP 5.3.2.1. Obtain the predicted dilution factors at specified locations.

- ESRP 5.4.2. Provide the exposure pathway data, including receptor locations, population distributions, food production, processing and consumption data, and atmospheric and hydrological data, as required, to estimate both individual and population doses.

- ESRP 5.4.4. Provide the site-specific pathway exposure data, as required, to estimate the radiation exposure to biota other than man.

- ESRP 6.2. Provide a list of receptor locations to be considered in evaluating the applicant's proposed preoperational radiological monitoring program or an existing radiological environmental monitoring program.

- ESRP 7.1. Provide information regarding the anticipated exposure pathways.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data and information should be obtained to determine the site-specific exposure pathways:

- the distances from the reactor to the following points or areas for each of the 22½-degree radial sectors centered on the 16 cardinal compass directions (from the environmental report [ER]):

  - nearest site boundary

  - to a distance of 8 km (5 mi), identify the receptor and its location for the nearest residence, milk cow, milk goat, meat animal, and vegetable garden larger than 50 m^2

- when the applicant proposes elevated releases of radioactive effluents as defined in Regulatory Guide 1.111, Rev. 1., *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I* (NRC 1977), the location of all milk cows, milk goats, meat animals, residences, and vegetable gardens larger than 50 m^2 out to a distance of 5 km (3 mi).

- for the applicable locations noted above, the grazing seasons (give dates) and fraction of daily intake of cows, meat animals, and milk goats derived from pasture or fresh green chop during the grazing season. Information should be obtained on the fraction of the year that leafy vegetables are grown and the average absolute humidity in grams per cubic meter during the growing season (from the ER).

- the nearest present and known future locations from which an individual can obtain aquatic food and/or drinking water (from the ER)

- the nearest present and known future shoreline areas that an individual can use for recreational purposes (from the ER)

- for the two locations noted immediately above, the transit time of each plant discharge stream containing liquid radwaste discharge from the point at which the stream enters an unrestricted area to the identified location, and the estimated stream dilution at that location. Information should be obtained on where reconcentration of liquid radwaste may occur. A description of such locations and the estimated reconcentration factors (from the ER) should be provided.

- for each liquid radwaste discharge, the transit time from input to a plant discharge stream to the point at which the stream enters an unrestricted area and the stream discharge in cubic meters per second (from the ER)

- the following distributional data for each of the 22½-degree radial sectors centered on the 16 cardinal compass directions for radial distances of 2, 4, 6, 8, 10, 20, 40, 60, and 80 km (1.2, 2.5, 3.7, 5, 6.2, 12, 25, 27, and 50 mi) from the reactor (from the ER):

  - projected population for 5 years from the time of the licensing action under consideration (see Figures 2.5.1-1 and 2.5.1-2 in ESRP 2.5.1)
  - present annual meat production (kg/yr)
  - present annual milk production (liter/yr)
  - present annual vegetable production (kg/yr)
  - the applicant's estimate of direct radiation doses from such sources as boiling-water reactor (BWR) turbines and outdoor radwaste storage tanks.

- the present commercial fish and invertebrate catch (in kg/yr) from waters within 80 km (50 mi) downstream (or 80-km [50-mi] radius for lake or coastal sites) of the plant radwaste discharge; major catch locations, their distance from the plant radwaste discharge, and the amount caught within

80 km (50 mi) of the plant that is consumed; transit time from the point at which the discharge stream enters an unrestricted area to each major catch location, the estimated dilution at each location, and the basis for calculating transit time and dilution (from the ER)

- present and known future drinking water intake locations within 80 km (50 mi) of the plant radwaste discharge (downstream or radius); the transit time and estimated dilution at each major location, the basis for calculating transit time and dilution, and the populations served or the daily water consumption at each location (from the ER)

- the irrigation rate (liter/m^2/month), crop yield (kg/m^2), annual production (kg/yr), and growing period (days) for irrigated land using water withdrawn within 80 km (50 mi) of the plant radwaste discharge (downstream or radius) when crop production has the potential for contributing 10% or more to individual or population doses because of liquid effluents; the crop type and its use (e.g., human consumption, meat animals), total crop production (by type) within the 80-km (50-mi) distance, and the amounts consumed within an 80-km (50-mi) radius of the plant; transit time from the point at which the discharge stream enters an unrestricted area to the points of withdrawal, estimated dilution at each withdrawal point, and the bases for calculating transit times and dilution factors (from the ER)

- unusual animals, plants, agricultural practices, game harvests, or food processing operations having the potential for contributing 10% or more to either individual or population doses (examples are harvesting Asiatic clams found in the surface-water intake of a municipality, harvesting seaweed, [e.g., moss] in areas affected by liquid effluents, growing sweet potatoes in excess of any other food crop, producing most of the region's potatoes in the general vicinity of the reactor, producing deer in a game-management area in quantities comparable to beef and pork production), and food-processing operations involving large quantities of water (e.g., the annual production and water-supply sources for breweries and bottling plants (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for analyzing the radiological impacts of normal operations with respect to exposure pathways are based on the relevant requirements of the following:

- 10 CFR 50, Appendix I, with respect to guidelines for assessing radiological impacts from normal operations. Note: This criterion is not applicable to early site permit applications.

- 10 CFR 20.1301(d) with respect to exposure pathways.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 1.109, Rev. 1, *Calculation of Annual Doses to Main from Routing Releases of Reactor Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I* (NRC 1976), with respect to calculating individual and population doses from routine effluents

Technical Rationale

The technical rationale for evaluating the applicant's exposure pathways is discussed in the following paragraph:

> To adequately evaluate the radiological impact of radiological releases from a light-water-cooled reactor, the exposure pathways, including receptor locations, should be determined. Receptor locations include areas having populations such as schools, hospitals or residences, or they may be locations at which plants or animals that become food for the public may be exposed to either direct radiation or contamination. Parameters necessary to determine the exposure pathways to calculate the dose (in Section 5.4.2) include the population of the affected area (assumed to be within an 80-kilometer [50-mile] radius), the distance from the reactor to the receptor location, and the time required for the plume to reach the receptor locations. In some cases, realistic assumptions should be made to determine the exposure pathways. All the assumptions used in determining the exposure pathways should be documented. This collection of information forms the basis for calculating doses to individuals from routine releases of reactor effluents so they can be compared to the guidelines for releases in 10 CFR 50, Appendix I.

III. REVIEW PROCEDURES

In this analysis, the reviewer should identify potential pathways for the transfer of radioactive materials from the plant or plant effluent streams to individuals. The analysis should consist of two parts: (1) identification of the pathways leading to maximum individual dose commitments and (2) identification of the pathways that will be used to calculate the overall dose estimate due to plant operation. Figures 5.4.1-1 and 5.4.1-2 represent the usual pathways associated with the transfer of radioactive materials to individuals and other biota and should be used by the reviewer to determine on a site-specific basis the pathways of interest for the proposed plant or site. The following pathways should be considered:

- direct radiation from the plant (for determining compliance with 10 CFR 20.1301(d)), including onsite independent spent fuel storage installations and onsite waste facilities

- for gaseous effluents:
  - immersion in the gaseous plume
  - inhalation of iodines and particulates
  - ingestion of iodines and particulates through the milk cow, milk goat, meat animal, and vegetation pathways
  - radiation from iodines and particulates deposited on the ground.

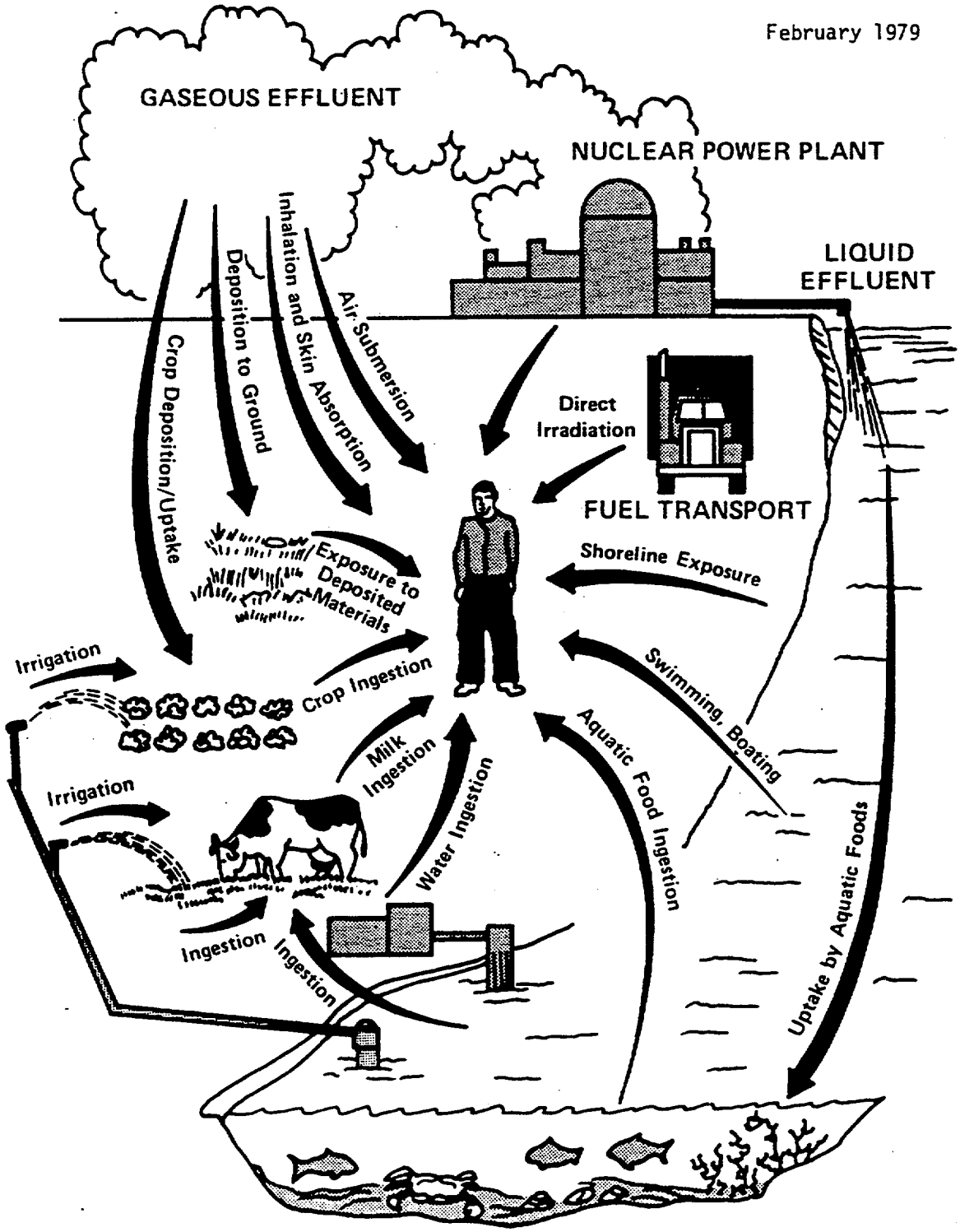

Figure 5.4.1-1. Exposure Pathways to Man

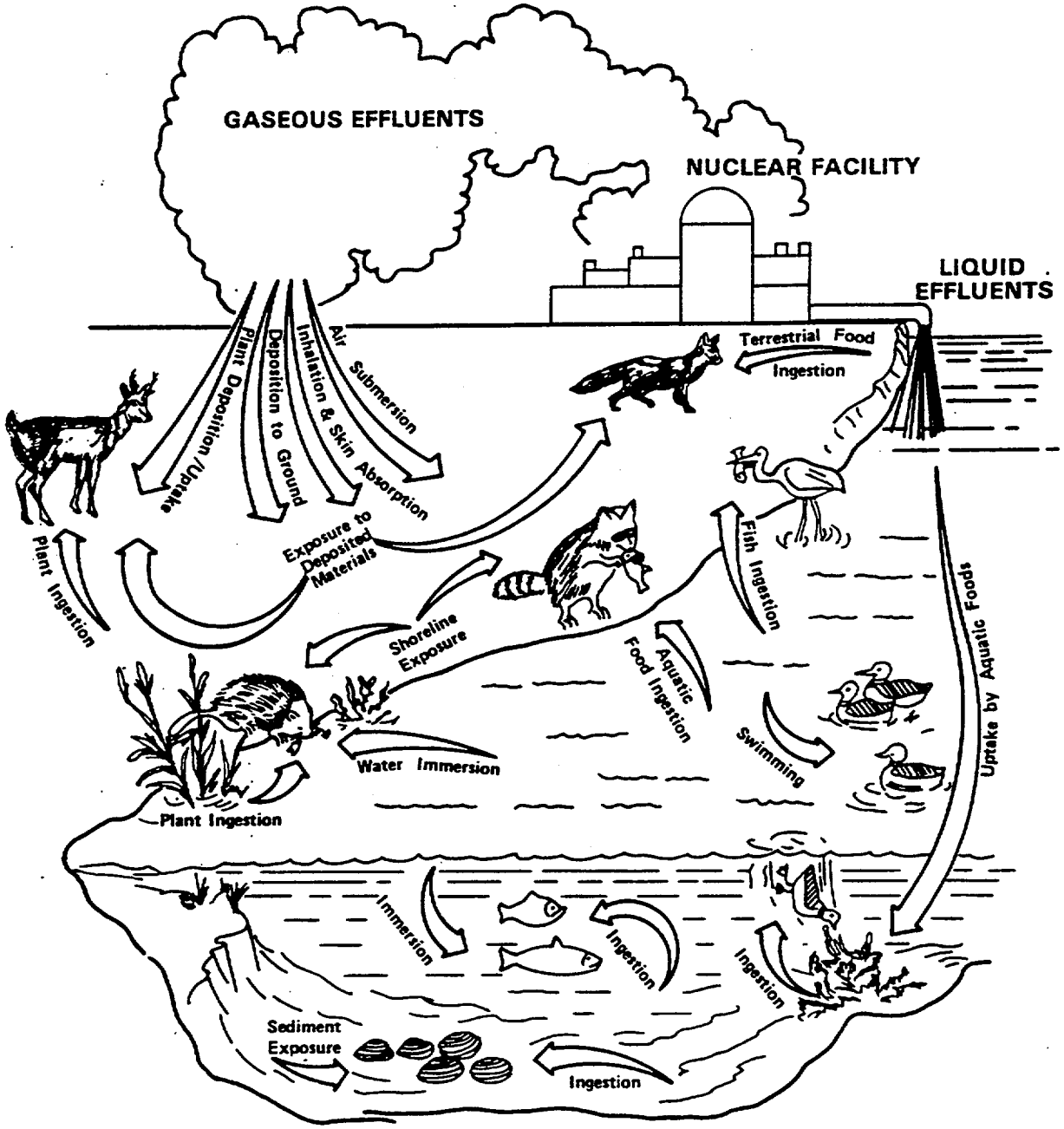

Figure 5.4.1-2. Exposure Pathways to Biota Other than Man

- for liquid effluents:
  - drinking water
  - ingestion of fish and invertebrates
  - shoreline activities for water containing radioactive effluents.

In addition, the reviewer should examine site-specific data to look for any unusual pathways uniquely associated with the proposed plant, and when any such exist, the reviewer should include them in the analysis.

Pathways for Maximum Individual Doses

To identify the pathways leading to maximum individual dose commitments, take the following steps:

(1) Based on information provided by the applicant, information obtained during the site visit, consultation with appropriate ESRP Chapter 2.0 reviewers, and consultation with appropriate Federal, State, regional, local, and affected Native American tribal agencies,

- Develop a list of "nearest" receptors as described in this ESRP.

- For each such location, categorize the important pathways (i.e., direct radiation or gaseous or liquid effluent) by which radiation can be transferred to the receptor.

(2) For gaseous pathways

- Give the location data to the reviewer for ESRP 2.7, Meteorology, for determining atmospheric transport and diffusion characteristics needed to determine dose commitments at these locations.

- Give the reviewer for ESRP 2.7 assistance as needed to complete this interrelated portion of the environmental review. Note: For early site permit applications, consult with the ESRP 2.7 reviewer to determine a conservative effluent release point for the hypothetical plant.

(3) For liquid pathways

- Consult with the reviewer of ESRP 3.5 to complete the analysis of the information required in this ESRP and with the reviewer of ESRP 2.3.1, to complete the analysis of transit and dilution times.

  When these reviewers determine that the applicant supplied values for transit time and dilution are conservative (e.g., with respect to stream flow and velocity), the applicant's data may be used without further analysis.

- For early site permit applications, consult with the reviewers of ESRPs 2.3.1 and 3.5 to determine the optimum effluent release point given the applicant's general statements about proposed cooling systems.

- If the applicant's data are not conservative or if subsequent dose-estimations calculations and analyses made by the reviewers of ESRPs 5.4.2 and 5.4.3 predict that doses will exceed the 10 CFR 50, Appendix I, guidelines, request that the reviewer of ESRP 2.3.1 provide detailed hydrological dispersion factors.

- As needed, provide assistance to the reviewer of ESRP 2.3.1 to complete this interrelated portion of the environmental review.

Pathways for Overall Dose

To identify pathways that will be used to calculate the overall dose estimate, take the following steps:

(1) Refer to the information identified in the "Data and Information Needs" of this ESRP.

- Base the review on information supplied by the applicant and supplemented by information obtained during the site visit, consultation with appropriate ESRP Chapter 2.0 reviewers, and consultation with appropriate Federal, State, regional, local, and affected Native American tribal agencies.

- Using these data, develop the appropriate exposure pathways, and document all assumptions.

- Obtain assistance from and coordinate with the reviewer of ESRPs 2.3.1, 2.7, and 3.5 in the same manner as described for the review of maximum individual dose pathways.

(2) Ensure that the analysis of exposure pathways has resulted in the following identifications and determinations:

- the locations of all important receptors

- the important exposure pathways to each receptor

- atmospheric transport and diffusion calculations (by the reviewer for ESRP 2.7) at each appropriate receptor location

- effluent release points, transit times to unrestricted area boundaries, and diluted stream flows at these boundaries (to be verified by the reviewer for ESRP 3.5). Note: For early site permit applications, certain assumptions may need to be made regarding effluent release points.

- transit times and dilution factors at each appropriate receptor location (to be verified in consultation with the reviewer for ESRP 2.3.1)

- population distribution data for 5 years following the time of the license action being considered (to be verified by the reviewer for ESRP 2.5.1)

- present annual milk, meat, and vegetable production (to be verified in consultation with the reviewers for ESRP 2.2).

(3) As a final step in the evaluation process, consult with the reviewer of ESRP 5.4.2 to ensure that sufficient data have been provided to permit calculation of individual and population dose commitments.

IV. EVALUATION FINDINGS

Input to the EIS should describe the following: (1) the typical pathways by which radioactive materials can be transported from the plant to receptors in unrestricted areas, (2) the pathways identified as important for the proposed project and a brief discussion of the staff's analysis to determine these pathways, (3) the nearest receptors identified by the reviewer, and (4) a brief discussion of food production and processing in the area. Use of Figures 5.4.1-1 and 5.4.1-2 is recommended.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 20, "Standards for Protection Against Radiation."

10 CFR 20.1301, "Dose limits for individual members of the public."

10 CFR 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Calculation of Annual Doses to Main from Routing Releases of Reactor Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I.* Regulatory Guide 1.109, Rev. 1, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.* Regulatory Guide 1.111, Rev. 1, Washington, D. C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.4.2 RADIATION DOSES TO MEMBERS OF THE PUBLIC

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's estimation of individual and collective doses due to radioactive gaseous and liquid effluents released from the plant in the course of normal plant operation. The scope of the review directed by this plan should include calculation of (1) maximum individual doses and (2) total collective doses to the population within an 80-km (50-mi) radius of the plant for 5 years after the time of the licensing action being considered.

This information should be used to determine if the plant radioactive-waste-management and effluent-control systems meet the design objectives of 10 CFR 50, Appendix I, and the requirements of 10 CFR 50.34a. Note: This determination does not apply to early site permit applicants.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain hydrology data.
- ESRP 2.5.1. Obtain the population distribution for 80 km (50 mi) around the site for 5 years after the time of the licensing action being considered.
- ESRP 2.7. Obtain meteorological data.

- ESRP 3.5. Provide the calculated maximum individual and population dose commitments for comparison with the design objective guidelines of 10 CFR 50, Appendix I.

- ESRP 3.8. Obtain input on whether the environmental impacts of transportation of radioactive wastes meet the criteria of Table S-4 of 10 CFR 51 or whether a supplemental impact assessment will be needed.

- ESRP 4.5. Obtain the construction work force collective annual dose for use in analyzing relevant doses to the public that would occur from plant operations.

- ESRP 5.4.1 Obtain receptor locations.

- ESRP 5.4.3. Provide the estimated maximum individual dose and population dose.

- ESRP 5.4.4. Provide atmospheric dispersion data, hydrological transport and dilution data, and dose data so that this reviewer can evaluate any potential radiological impacts to biota other than man.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- information related to exposure pathways (from ESRP 5.4.1), including

  - receptor locations
  - population distribution
  - meteorological dispersion data
  - hydrological dilution data.

- gaseous and liquid source term data (from the ESRP for environmental impact statement [EIS] 3.5)

- exposure rates associated with onsite out-of-plant storage of solid waste

- applicant calculated dose data (from the ER)

- occupational radiation dose estimates (from the ER)

- natural radiation doses that are generally applicable to the site (from the general literature) (NCRP 1987).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the analysis and evaluation of doses resulting from radioactive gaseous and liquid effluents released during normal operations are based on relevant requirements of the following:

- 10 CFR 50, Appendix I, with respect to determination of doses
- 10 CFR 50.34a with respect to determination of estimated dose
- 10 CFR 20.1301(d) with respect to doses to members of the public as a result of exposures to discharges of radioactive material, radon, and direct radiation from a site.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Regulatory Guide 1.109, Rev. 1, *Calculation of Annual Doses to Man from Routing Releases of Reactor Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I* (NRC 1976), with respect to determination of doses to the public
- NUREG-0543, *Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard* (NRC 1980), with respect to determination of compliance with 10 CFR 20.1301(d).

Technical Rationale

The technical rationale for evaluating the applicant's estimation of radiation doses to members of the public is discussed in the following paragraph:

All light-water-cooled reactors release small quantities of radioactive materials to the environment. The criteria for doses from liquid effluents and air dose from gaseous effluents for any individual in an unrestricted area from all pathways of exposure are designed to provide a means of ensuring that effluent releases from light-water-cooled reactors are below levels that could have a negative impact. The doses to individuals from radioactive gaseous and liquid releases and the doses to the population within 80 km (50 mi) of the plant are assessed before plant operations to ensure that the plant design is so that effluent releases meet the 10 CFR 50, Appendix I, criteria.

III. REVIEW PROCEDURES

The reviewer's analysis of doses is usually an iterative process in coordination with the reviewer for ESRP 3.5 and adheres to the following general steps:

(1) Calculate the dose to the maximally exposed individual and collective dose estimates.

- Forward these estimates to the reviewer for ESRP 3.5 for comparison with the design objectives and to evaluate the radwaste cost estimate described in 10 CFR 50, Appendix I.

  If the reviewer for ESRP 3.5 determines that the doses do not meet these design objectives, additional analysis may be needed, and on this basis, source terms may be revised by the ESRP 3.5 reviewer.

- If the source terms are revised, use them to calculate another set of individual maximum doses and collective population doses and forward it to the reviewer for ESRP 3.5 for evaluation.

- Repeat this procedure until the reviewer for ESRP 3.5 determines that the applicant's radioactive waste management system meets the design objectives of 10 CFR 50, Appendix I.

Estimation of Doses from Gaseous and Liquid Radioactive Releases

In conducting the following analysis, the reviewer should be thoroughly familiar with the information and procedures specified in Regulatory Guide 1.109 (NRC 1976) and with the GASPAR and LADTAP computer codes used to estimate doses from gaseous and liquid radioactive releases. The reviewer should take the following steps in performing the analyses of releases:

(1) Assemble the gaseous and liquid source term data provided by the reviewer for ESRP 3.5, the receptor location and exposure pathway data (including hydrological and meteorological dispersion factors) provided by the reviewer for ESRP 5.4.1, and any additional hydrological and meteorological data provided by the reviewers for ESRPs 2.3.1 and 2.7.

(2) For iodines and particulates in gaseous effluents, examine the receptor locations, associated pathways, and relative deposition (D/Q) values. Select those locations expected to result in the maximum individual dose for input to the GASPAR computer code.

(3) For noble gases in gaseous effluents, examine the normalized concentration (χ/Q) values at the site boundary for each of the 16 compass sectors that intersect land.

  - For sites that have water boundaries, examine the meteorological atmospheric dispersion factors for land in sectors beyond the water boundary to determine if any of these locations have higher factors than the other land site-boundary factors.

  - Determine the location at which the meteorological atmospheric dispersion factor will result in the maximum beta and gamma air dose and the maximum total body and skin dose to an individual.

  - Select data from this location for input to the GASPAR computer code.

(4) For liquid pathways, examine the receptor locations, hydrological data, and associated exposure pathways to select the location expected to result in the maximum individual dose input to the LADTAP computer code.

(5) For the locations identified in Items 2, 3, and 4 above, assemble and enter the appropriate data needed to run the GASPAR and LADTAP computer codes.

- If input data needed by these codes are lacking and cannot be supplied, use default values (as provided in Regulatory Guide 1.109 [NRC 1976]) for these parameters.

- If either code is not sufficient because some important pathways identified by the reviewer for ESRP 5.4.1 are not included in the codes, employ special calculations. These calculations may involve the review of available literature and development of a model describing the pathway.

(6) When site-specific conditions are so that it is not obvious that the particular location will result in maximum individual dose, select two or more locations for input to the GASPAR and LADTAP codes, then identify the "maximum" location based on the code outputs.

(7) Do not analyze the doses resulting from the transportation of radioactive material unless the reviewers for ESRPs 3.8 or 5.4 indicate that an analysis of these pathways is needed.

- When this is the case, extend the analysis to cover these pathways, using an analysis and evaluation procedure developed in consultation with these reviewers.

- An analysis of occupational radiation exposure from the transportation of radiology materials is not required.

(8) Analyze direct radiation doses to individuals in the vicinity of the site. During this analysis, evaluate the applicant's estimates of doses from direct radiation.

- If these estimates appear reasonable and justified, they may be used directly in the staff's analysis.

- If not, ask the applicant to submit additional information so that the staff can adequately evaluate these sources.

- The doses from direct radiation are combined with the doses from gaseous and liquid effluents.

- The dose is to be calculated at a point in the offsite environment. Each unit's contribution to the dose at that point should be added to determine the total. For example, contributions of stored waste to the dose at any point from each unit will vary depending on the distance from that unit to the point at which dose from the site is evaluated.

The reviewer should take the following steps in performing the evaluation:

(1) Assess the computer outputs to ensure that data were entered properly and that the outputs appear normal.

(2) For noble gases in gaseous effluents from the GASPAR output, determine the maximum beta and gamma dose in air and the maximum dose to total body of an individual and dose to the skin of an individual. Identify the site boundary location for these doses.

(3) For iodines and particulates released to the atmosphere, from the GASPAR output, determine the dose to any organ from all pathways. This dose should be for the age group (adult, teenager, child, or infant) receiving the highest dose. The dose should include the ground plane and inhalation pathways that are present at all receptor locations, plus those pathways that are applicable to the particular location. The plume pathway from the GASPAR code is due to noble gases and is not included in the iodine and particulate release pathways. Identify the receptor location for these doses.

(4) For liquid effluents, from the LADTAP output, determine the maximum total body and organ dose to an individual. This dose should be for the age group (adult, teenager, or child) receiving the highest dose. It should be the sum of the pathways that are present in the vicinity of the site, although not necessarily at the same location. Thus, an individual fishing in the plant outfall region is assumed to be obtaining drinking water from the nearest potable water intake affected by plant operation. Identify the receptor location for these doses.

(5) From the GASPAR and LADTAP outputs, determine the dose to the total body from all pathways and the dose to any organ from all pathways.

(6) Compare the dose data from Items 2 through 5 (above) with the dose data calculated by the applicant. For significant differences, consult with the reviewer for ESRP 3.5 and with the applicant to determine the reasons for these variations.

(7) Consult with the reviewer for ESRP 3.5 to determine if the dose commitments calculated above meet the design objectives of Appendix I to 10 CFR 50. If the reviewer for ESRP 3.5 determines that the dose does not meet these design objectives, the following procedure should be used:

- Ask the reviewer for ESRP 5.4.1 to re-evaluate the exposure pathway data. The objective of this re-evaluation is to determine if conservative estimates have been used, and if so, to see if more realistic pathway data can be identified that would result in decreased dose predictions. When more realistic input data can be identified, repeat the preceding review procedures of this ESRP and provide the reviewer for ESRP 3.5 with the revised dose calculations.

- If, upon re-analysis, the exposure pathway data are shown to be realistic and still result in a prediction that doses will not meet 10 CFR 50 design objectives, request that the applicant

commit to additional treatment equipment and effluent control measures. When advised that such commitments have been made, the reviewer for ESRP 3.5 should calculate revised source terms, and you should repeat the preceding instructions to provide the reviewer for ESRP 3.5 with the revised dose calculations. Note: For the early site permits, this re-analysis is not necessary.

(8) Compare the doses from all pathways (including direct radiation) for all units at the site with the dose criteria referenced by 10 CFR 20.1301(d). If the doses from the site exceed the criteria in 40 CFR 190, request that the applicant commit to additional shielding or other source control measures as appropriate.

IV. EVALUATION FINDINGS

Input to the EIS should present the calculated doses based on the exposure pathways determined by the reviewer for ESRP 5.4.1. The following information should be included in ESRP 5.4.2:

- doses to individuals from the radioactive gaseous and liquid releases and direct radiation
- doses to the population within an 80-km (50-mi) radius of the plant from the radioactive gaseous and liquid releases
- a discussion of or reference to the staff's analysis procedures and the parameters used in the staff calculations
- when required by the reviewers for ESRPs 3.8 or 5.4, estimated doses resulting from the transportation of radioactive materials, including a brief discussion of the reasons for and methods of the staff analysis
- for occupational radiation exposure and for direct radiation and transportation of radioactive material when a separate dose calculation is not required, the inputs as given should be used
- as a general rule, the following figures and tables should be used in the EIS input:
  - exposure pathways (by referring to ESRP 5.4.1)
  - population distribution (by referring to ESRP 2.5.1)
  - calculated releases of radioactive materials in liquid effluents (source term) (see Table 5.4.2-1)
  - calculated releases of radioactive materials in gaseous effluents (source term) (see Table 5.4.2-2)
  - summary of normalized concentration and relative deposition values (see Table 5.4.2-3)
  - annual maximum individual dose due to gaseous and liquid effluents (see Table 5.4.2-4)
  - summary of hydrologic transport and dilution factors (see Table 5.4.2-5).

When the reviewer has determined that the maximum individual doses comply with 10 CFR 50, Appendix I, a statement similar to the following should be used in the EIS:

The staff reviewed the available information relative to the radiological impacts of normal operation with respect to dose. The staff concludes that the design objectives for release of radiological effluents are being met.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 20.1301, "Dose limits for individual members of the public."

10 CFR 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

10 CFR 50.34a, "Design objectives for equipment to control releases of radioactive material in effluents—nuclear power reactors."

10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

National Council on Radiation Protection and Measurements (NCRP). 1987. *Exposure of the Population in the United States and Canada from Natural Background Radiation*. NCRP Report No. 94.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Calculation of Annual Doses to Man from Routing Releases of Reactor Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I.* Regulatory Guide 1.109, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977a. *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.* Regulatory Guide 1.111, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977b. *Calculations of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors*. Regulatory Guide 1.112, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1980. *Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard* (40 CFR 190). NUREG-0543, Washington, D.C.

Table 5.4.2-1. Calculated Releases of Radioactive Materials in Liquid Effluents*

Nuclide	Release, Bq/yr/reactor	Nuclide	Release, Bq/yr/reactor
Corrosion and Activation Products		**Fission Products (contd)**	
Na-24	2.1(8)[a,b]	Ru-103	2.6(6)
P-32	2.2(7)	Rh-103m	2.2(6)
Cr-51	5.6(8)	Ru-105	2.6(6)
Mn-54	8.5(6)	Rh-105m	2.6(6)
Mn-56	6.3(6)	Rh-105	1.4(7)
Fe-55	1.2(8)	Ru-106	3.3(6)
Fe-59	3.3(6)	Ag-110	7.4(5)
Co-58	2.9(7)	Te-129m	4.4(6)
Co-60	5.9(7)	Te-129	3.0(6)
Cu-64	5.6(8)	Te-131m	4.8(6)
Zn-65	2.4(7)	Te-131	7.4(5)
Zn-69m	4.1(7)	I-131	3.1(9)
Zn-69	4.4(7)	Te-132	7.4(5)
Zr-95	1.9(6)	I-132	3.0(5)
Nb-95	2.6(6)	I-133	8.1(8)
W-187	1.2(7)	Cs-134	4.8(7)
Np-239	4.8(8)	I-135	1.1(8)
Fission Products		Cs-136	2.0(7)
Sr-89	1.2(7)	Cs-137	1.1(8)
Sr-90	7.4(5)	Ba-137m	7.4(7)
SR-91	4.4(7)	Ba-140	4.1(7)
Y-91m	2.9(7)	La-140	2.0(7)
Y-91	7.4(6)	La-141	3.7(5)
Sr-92	1.5(6)	Ce-141	3.7(6)
Y-92	1.6(7)	Ce-143	1.5(6)
Y-93	4.8(7)	Pr-143	4.4(6)
Zr-95	7.4(5)	Ce-144	6.7(6)
Nb-95	7.4(5)	All others[b]	2.2(6)
Mo-99	1.5(8)	Total (except H-3)	7.0(9)
Tc-99m	2.1(8)	H-3	5.6(11)

(a) Exponential notation: 5.7(-3) = 5.7 x 10^{-3}.

(b) Nuclides whose release rates are less than 3.7 x 10^{5} Ci/yr/reactor are not listed individually, but are included in the category "All others."

*The values are illustrative only.

Table 5.4.2-2. Calculated Releases of Radioactive Materials in Gaseous Effluents (Bq/yr/reactor)*

Nuclides	Waste Gas System	Reactor	Building Ventilation		Glad Seal and Mechanical Vacuum Pump	Total
			Radwaste	Turbine		
Ar-41	(a)	9.3(11)	(a)	(a)	(a)	9.3(11)
Kr-83m	1.9(11)	(b)	(b)	(b)	3.2(12)	3.4(12)
Kr-85m	6.7(13)	2.2(11)	(b)	2.5(12)	5.6(12)	7.4(13)
Kr-85	1.0(12)	(b)	(b)	(b)	(b)	1.0(12)
Kr-87	(b)	2.2(11)	(b)	4.8(12)	1.9(13)	2.4(13)
Kr-88	2.5(13)	2.2(11)	(b)	8.5(12)	1.9(13)	5.2(13)
Kr-89	(b)	(b)	(b)	(b)	8.1(13)	8.1(13)
Xe-131m	2.7(12)	(b)	(b)	(b)	(b)	2.7(12)
Xe-133m	6.3(11)	(b)	(b)	(b)	5.6(11)	8.9(11)
Xe-133	4.1(14)	4.8(12)	3.7(11)	9.3(12)	9.3(13)	5.2(14)
Xe-135m	(b)	3.4(12)	(b)	2.4(13)	2.3(12)	3.0(13)
Xe-135	(b)	6.7(12)	1.7(12)	2.4(13)	3.4(14)	6.3(13)
Xe-137	(b)	(b)	(b)	(b)	1.0(13)	1.0(13)
Xe-138	(b)	5.2(11)	(b)	5.2(13)	7.8(13)	1.3(14)
I-131	(b)	7.0(9)[c]	1.9(9)	7.0(4)	4.1(9)	2.0(10)
I-133	(b)	2.8(10)	6.7(9)	2.8(10)	1.2(10)	7.4(10)
H-3	--	--	--	--	--	2.6(12)
C-14	3.0(11)	5.6(10)	(b)	(b)	(b)	3.5(11)
Cr-51	(a)	1.1(7)	3.3(6)	4.8(8)	(a)	4.8(8)
Mn-54	(a)	1.1(8)	1.1(9)	2.2(7)	(a)	1.4(8)
Fe-59	(a)	1.5(7)	5.6(6)	1.9(7)	(a)	4.1(7)
Co-58	(a)	2.7(7)	1.7(6)	2.2(7)	(a)	4.8(6)
Co-60	(a)	3.7(8)	3.3(7)	7.4(7)	(a)	4.8(7)
Zn-65	(a)	7.4(7)	5.6(5)	7.4(6)	(a)	8.1(7)
Sr-89	(a)	3.5(6)	1.7(5)	2.2(8)	(a)	2.3(8)
Sr-90	(a)	1.9(5)	1.1(3)	7.4(5)	(a)	1.0(6)
Zr-95	(a)	1.5(7)	1.9(4)	3.7(6)	(a)	1.9(7)
Sb-124	(a)	7.4(6)	1.9(4)	1.1(7)	(a)	1.9(7)
Cs-134	(a)	1.5(8)	1.7(6)	1.1(7)	1.1(5)	1.6(8)
Cs-136	(a)	1.1(7)	1.7(5)	1.9(6)	7.4(4)	1.3(7)
Cs-137	(a)	2.0(8)	3.3(6)	2.2(7)	3.7(5)	2.3(8)
B[a]-140	(a)	1.5(7)	3.7(4)	4.1(8)	4.1(5)	4.1(8)
Ce-141	(a)	3.7(5)	9.6(5)	2.2(7)	(a)	2.7(7)

(a) Less than 1% of total nuclide.
(b) Less than 3.7×10^{10} Bq/yr/reactor for noble gases and carbon-14; less than 3.7×10^{6} Bq/yr/reactor for iodine.
(c) Exponential notation: $1.9(-1) = 1.9 \times 10^{-1}$.
*The values are illustrative only.

Table 5.4.2-3. Summary of Normalized Concentration and Relative Deposition Values for Selected Locations[a]

Location[b]	Source[c]	Normalized Concentration, χ/Q(sec/m^3)	Relative Deposition, D/Q (m^{-2})
Nearest site land boundary (0.61 km SW*)	A B	5.6×10^{-8}* 2.5×10^{-7}*	9.2×10^{-9}* 4.0×10^{-8}*
Nearest residence, garden, animal meat, and milk animal (1.5 km SW*)	A B	2.1×10^{-8}* 9.4×10^{-8}*	3.3×10^{-9}* 1.4×10^{-8}*

(a) The doses presented in the following tables are corrected for radioactive decay and cloud depletion from deposition where appropriate, in accordance with Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water Reactors* (NRC 1977a).
(b) "Nearest" refers to that type of location at which the highest radiation dose is expected to occur from all appropriate pathways.
(c) Source A is continuous stack release; Source B is periodic stack release, 4 times/yr at 24-hr duration each.
*The values are illustrative only.

Table 5.4.2-4. Annual Dose to a Maximally Exposed Individual

Location	Pathway	Radioiodine and Particulates in Gaseous Effluents*		
		Total Body		
Nearest[a] Farm Residence, Milk Cow, and Meat Animal (3.2 mi NW)*	Ground Deposit Inhalation Milk (Infant)	0.092 mrem/yr/unit <0.01 mrem/yr/unit 0.024 mrem/yr/unit		
Totals		0.12 mrem/yr/unit		
		Liquid Effluents		
		Total Body	Any Organ	
Nearest Drinking Water-Cooling Lake	Water Ingestion	0.1 mrem/yr/unit	<0.1 mrem/yr/unit	
Nearest Fish at Cooling Lake	Fish Ingestion	1.2 mrem/yr/unit	0.7 mrem/yr/unit	
Irrigated Foods	Vegetation, Milk, and Meat (Adult)	<0.1 mrem/yr/unit	<0.1 mrem/yr/unit	
Totals		1.4 mrem/yr/unit	1.0 mrem/yr/unit	
	Noble Gases in Gaseous Effluents*			
	Total Body	Skin	Gamma Air Dose	Beta Air Dose
Nearest[b] site boundary (1.2 mi. S)*	4.3 mrem/yr/unit	6.8 mrem/yr/unit	6.4 mrad/yr/unit	2.6 mrad/yr/unit

(a) "Nearest" refers to the location at which the highest radiation dose to an individual from all applicable pathways has been estimated.
(b) "Nearest" refers to that site boundary location at which the highest radiation doses due to gaseous effluents have been estimated to occur.
*The values are illustrative only.
Note: These values will be converted to appropriate SI units in the final version of the ESRP.

Table 5.4.2-5. Summary of Hydrologic Transport and Dilution of Liquid Releases[a]

Location	Transit Time (Hours)	Dilution Factor
Nearest municipal water intake (Lincoln, Any State)	10*	160*
Nearest shoreline (plant outfall)	0.1*	1*

(a) See Regulatory Guide 1.112, *Analytical Models for Estimating Radioisotope Concentrations in Different Water Bodies*, (NRC 1977b).
*The values are illustrative only.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.4.3 IMPACTS TO MEMBERS OF THE PUBLIC

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation and presentation of a summary analysis and evaluation of the radiological impacts on individuals due to radioactive effluents released from the plant in the course of normal operation.

The scope of the review directed by this plan should include (1) a comparison of the maximum individual doses estimated by the reviewer for ESRP 5.4.2 with the design objectives of 10 CFR 50, Appendix I, (2) a comparison of the maximum individual doses for all pathways (including direct radiation) estimated by the reviewer for ESRP 5.4.2 with the requirements in 10 CFR 20.1301(d), and (3) an evaluation of the collective dose for the population within 80 km (50 mi) of the plant.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.3.2. Obtain water-use information to support the analysis of public dose from waterborne sources.
- ESRP 5.4.2. Obtain the estimated individual and collective doses.
- ESRP 5.4.4. Provide information on the maximum site-specific doses to members of the public.

- ESRP 7.1. Provide the dose consequences and health effects associated with normal operational releases.

- ESRP 10.4.2. Provide a summary of the maximum individual and collective dose estimates.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- radiation dose data (from ESRP 5.4.2), including

  - maximum individual doses from liquid effluents
  - maximum individual doses from gaseous effluents
  - maximum individual doses from direct radiation sources
  - collective doses to the population within 80 km (50 mi) of the plant
  - occupational collective doses.

- natural radiation doses that are generally applicable to the site (from NCRP [1987]).

II. ACCEPTANCE CRITERIA

Acceptance criteria for determining the radiological impacts to individuals from releases during routine operations including anticipated operational occurrences of the reactor are based on the relevant requirements of the following:

- 10 CFR 50, Appendix I, with respect to radiological impacts to individuals from the radiological effluent releases from reactors

- 10 CFR 20.1301 with respect to the guidelines for radiological effluent releases from reactors. Note: In accordance with the statement of considerations for 10 CFR 20 (5 CFR 23360), demonstration of compliance with the limits of 40 CFR 190 (as referenced in 10 CFR 20.1301(d)) is considered to be in compliance with the 0.1-rem limit (10 CFR 20.1301).

Regulatory guides and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 1.109; Rev. 1, *Calculation of Annual Doses to Man from Routing Releases of Reactor Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I* (NRC 1976), with respect to determining doses to the public from reactor effluents

- NUREG-0543, *Methods for Demonstrating LWR Compliance with the EPA* (NRC 1980), with respect to comparing doses to 10 CFR 20.1301(d) requirements as they relate to 40 CFR 190.

Technical Rationale

The technical rationale for evaluating the applicant's radiological impacts on individuals resulting from potential effluent releases from the plant is discussed in the following paragraph:

> The basis for determining whether an applicant's radioactive waste management system meets the design criteria in 10 CFR 50, Appendix I, consists of analyzing the dose to the public from the releases from the reactor. This evaluation is based on determining the annual maximum individual dose to a member of the public in the vicinity of the reactor and comparing it against the Appendix I design criteria. In addition, the individual doses from direct radiation sources are added to the doses from effluent releases for all units at the site and are compared with the 40 CFR 190 limits (as referenced in 10 CFR 20.1301(d)). These doses, along with the estimated annual releases from the reactor, are compared against the design criteria. The determination of exposure pathways from ESRP 5.4.1 and doses from ESRP 5.4.2 provide input to this evaluation.

III. REVIEW PROCEDURES

The analysis of radiological impacts to individuals should be based on the dose estimates prepared by the reviewer for ESRP 5.4.2 that have been evaluated by the reviewer for ESRP 3.5 and determined to be within the design objective guidelines of 10 CFR 50, Appendix I. The reviewer should take the following steps when analyzing radiological impacts.

(1) Prepare a table that compares these doses, on a per-unit (individual reactor) basis, with the Appendix I design objectives, using the format shown in Table 5.4.3-1.

(2) Determine the 80-km (50-mi) collective total body doses per reactor unit for liquid effluents, noble-gas effluents, and radioiodines and particulates, and compare these doses to the natural radiation background for this population.

(3) Include an estimate of the collective occupational dose using the format of Table 5.4.3-2.

(4) Consult with the reviewers for ESRPs 3.5 and 5.4.2 to verify the accuracy and completeness of the summary table based on Table 5.4.3-1.

(5) Verify the availability and accuracy of the following data that should be included as input to the environmental impact statement (EIS):

- the maximum individual doses and the collective doses to the population within 80 km (50 mi) of the plant, based on individual reactor releases

- the individual and collective doses due to total natural background radiation to the population within 80 km (50 mi) of the plant

- the estimated occupational collective dose.

IV. EVALUATION FINDINGS

A statement similar to the following should be used in the EIS:

> The radiological impact to man associated with normal operation of the plant, including anticipated operational occurrences, will depend on the manner in which the radioactive-waste-management system is operated. Based on the staff's evaluation of the anticipated performance of this system, it is concluded that the system as proposed is capable of meeting the dose design objectives of 10 CFR 50, Appendix I. Table 5.4.3-1 compares the calculated maximum individual doses, based on radiological effluent source terms that reflect the anticipated system performance, with these design objectives. In accordance with 10 CFR 20.1301(d), licensees must meet the provisions of 40 CFR 190. This standard specifies that reactor operations shall be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 0.25 mSv (25 mrem) to the whole body, 0.75 mSv (75 mrem) to the thyroid, and 0.25 mSv (25 mrem) to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment from uranium fuel cycle operations, and to radiation from these operations. Table 5.4.3-2 compares the doses from all pathways, including direct radiation from all units at the site to the 40 CFR 190 limits. The staff also concluded that the collective doses of _____[(a)]person-sievert/yr (__ person-rem/yr) to the population within 80 km (50 mi) of the plant (Table 5.4.3-3), including the annual estimated collective occupational dose, are not significant when compared with the annual collective natural radiation background doses of _____[(b)] person-sievert/yr (person-rem/yr) to the 80-km (50-mi) population. To estimate the risks to the population living within 80 kilometers (50 miles) of the _____ Site, the staff used the ICRP 60 (ICRP 1991) factor of approximately 1 severe hereditary effect per 110 person-sieverts (130 severe hereditary effects per million person-rem) which is multiplied by the dose from exposure to radioactivity attributable to the Site's effluents. As a result, the staff concluded that there will be no observable health impact to the public from normal operation of the plant.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

(a) The reviewer should insert values appropriate to the environmental review.
(b) The reviewer should insert values appropriate to the environmental review.

VI. REFERENCES

10 CFR 20, "Standards for Protection from Radiation."

10 CFR 20.1301, "Dose limits for individual members of the public."

10 CFR 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

International Commission on Radiological Protection (ICRP). 1991. *Recommendations on the International Commission on Radiological Protection*, Publication 60. Oxford Press, Oxford, England.

National Council on Radiation Protection and Measurements (NCRP). 1987. *Exposure of the Population in the United States and Canada from Natural Background Radiation*. NCRP Report No. 94, Bethesda, Maryland.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Calculation of Annual Doses to Man from Routing Releases of Reactor Effluents for the Purpose of Evaluating Compliance with CFR 50, Appendix I.* Regulatory Guide 1.109, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1980. *Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard (40 CFR Part 190)*. NUREG-0543, Washington, D.C.

Table 5.4.3-1. Comparisons of Annual Airborne and Liquid Releases and Associated Doses

Radionuclide Releases/Dose	Current NRC Assessment	Appendix I Design Objectives (per unit)	RM-50-2 Design Objectives (per site)
Gas			
Noble gas releases		0.2 mGy (20 mrad)β;[a] 0.1 mGy (10 mrad)γ	0.2 mGy (20 mrad)β;[a] 0.1 mGy (10 mrad)γ
Iodine-131 releases		—[b]	37 Gbq[c] (1 Ci)
Total body dose[d]		0.05 mSv (5 mrem)	0.05 mSv (5 mrem)
Organ dose[d]		0.15 mSv (15 mrem)	0.15 mSv (15 mrem)
Liquid			
Tritium releases		—[b]	—[b]
Other radionuclide releases		—[b]	185 GBq[c] (10 Ci)
Total body dose[d]		0.03 mSv (3 mrem)	0.05 mSv (5 mrem)
Maximum organ dose[d]		0.01 mSv (10 mrem)	0.05 mSv (5 mrem)

(a) Air dose calculated at site boundary or at the point of maximum dose.
(b) Not applicable
(c) Objectives for release quantities are expressed on a per unit basis.
(d) Maximally exposed individual

Table 5.4.3.-2. Comparison of Doses to 40 CFR 190[a]

Dose	NRC Dose Assessment	40 CFR 190 Requirements
Annual whole body dose equivalent[b]	mSv (mrem)	0.25 mSv (25 mrem)
Thyroid dose	mSv (mrem)	0.75 mSv (75 mrem)
Dose to another organ	mSv (mrem)	0.25 mSv (25 mrem)

(a) Doses are for all units at a site.
(b) This dose assessment includes all pathways for all effluents and direct radiation sources for all units at the site.

Table 5.4.3-3. Estimated Collective Total Body Dose Within 80 km (50 mi)

Exposed Population	Pathway	Collective Dose Person-Sv[a] (person-rem)	
		Per Unit	**Total**
General Public	Liquid	____	____
	Noble Gas	____	____
	Iodine and Particulate	____	____
	Total	____	____
	Natural Background	N/A	____
Occupational Workforce	External and Internal	____	____

(a) Although person-Sv is used as the preferred unit for collective dose, it should be recognized that the individual doses on which this collective dose is based are estimated using an older system of dose limitation (whole body and critical organ.) Thus, the values shown are not totally comparable with estimates expressed as total effective dose equivalent.

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5.4.4 IMPACTS TO BIOTA OTHER THAN MEMBERS OF THE PUBLIC

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and analysis to determine if there is any potential for significant radiological impacts to biota other than members of the public and, if so, to estimate the nature and magnitude of the impact.

The scope of the review directed by this plan should include an analysis of radiation-exposure pathways to biota other than members of the public to determine if any such pathways could be predicted to result in estimated doses greater than those predicted for man. The biota to be considered in this evaluation should include those in the pathways identified in ESRP 5.4.1, those appearing on the endangered/threatened species lists, and others of significance. When such pathways are found, the reviewer should determine the resultant estimated doses and compare them with the dose limitations of 40 CFR 190 as referenced in 10 CFR 20.1301(d). Dose criteria in 40 CFR 190 apply to individual members of the public rather than to biota; however, in this review, it is assumed that in the absence of regulatory dose criteria for biota, the public dose limits would apply.

Review Interfaces

The reviewer for this ESRP should provide input to or obtain input from the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.2. Obtain water-use information to support the analysis of impacts to aquatic biota.

- ESRP 2.4. Consult with the reviewer of ESRP 2.4 to determine other significant biota that should be evaluated.

- ESRP 5.4.1. Obtain information on the site-specific pathways for radiation exposure to biota other than members of the public.

- ESRP 5.4.2. Obtain atmospheric dispersion, hydrological transport and dilution, and dose data for the evaluation of potential radiological impacts to biota other than members of the public.

- ESRP 5.4.3. Obtain information on the maximum site-specific doses to members of the public.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a list of the biota to be considered in this evaluation, including those identified in ESRP 5.4.1, "important" species, as identified in ESRPs 2.4.1 and 2.4.2, including those appearing on the endangered/threatened species lists, and others identified in consultation with the reviewer of ESRP 2.4

- site-specific pathways for radiation exposure (from the reviewer of ESRP 5.4.1)

- doses to the maximally exposed individual (from the reviewer of ESRP 5.4.3).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the potential for significant radiological impacts to biota other than members of the public are based on the relevant requirements of the following:

- 40 CFR 190 with respect to radiation dose criteria to members of the public.

Technical Rationale

The technical rationale for evaluating the applicant's potential impacts to biota other than members of the public is discussed in the following paragraphs:

Evaluation of the potential for significant radiological impact to biota requires the consideration of the exposure pathways to biota and the determination if any of these pathways could be expected to result in doses significantly greater than those given in the acceptance criteria above. The regula

tions in 40 CFR 190 apply specifically to members of the public or other persons in unrestricted areas. These guidelines are, however, applied in this section to biota other than members of the public.

Depending on the pathway and the radiation source, terrestrial and aquatic biota will receive doses about the same or somewhat higher than members of the public receive. Although guidelines have not been established for acceptance limits for radiation exposure to species other than members of the public, it is generally agreed that the limits established for humans are also conservative for other species.

Experience has shown that it is the maintenance of population stability that is crucial to the survival of a species, and species in most ecosystems suffer rather high mortality rates from natural causes. The fate of individual organisms is generally not the major concern; rather, the response and maintenance of the endemic population is a major concern (NCRP 1991). Exceptions are threatened or endangered species where protection of the individual is required in the absence of an incidental take permit specifically for dose-related effects. Although the existence of extremely radiosensitive biota is possible, and whereas increased radiosensitivity in organisms may result from environmental interactions with other stresses (e.g., heat, biocides), no biota have yet been discovered that show a significantly increased sensitivity (in terms of increased morbidity or mortality) to radiation exposure at the predicted levels.

Furthermore, at all the nuclear power plants for which an analysis of radiation exposure to biota other than members of the public has been made, there have been no cases of exposures that can be considered significant in terms of harm to the species or that approach the exposure limits of 10 CFR 20 to members of the public (AEC 1975). The BEIR Report (BEIR 1972) concludes that the evidence indicates that no other living organisms have been identified that are likely to be significantly more radiosensitive than members of the public. The International Atomic Energy Agency (IAEA 1992) concludes that there is no convincing evidence from scientific literature that chronic radiation dose rates below 1 mGy/day (100 mrad/day) will harm animal or plant populations. Limiting exposure in humans to 1 mSv/yr (100 mrem/day) will lead to dose rates to plants and animals in the same area of less than 1 mGy/day (less than 100 mrad/day). The National Council on Radiation Protection and Measurements (NCRP) also concludes that the 1977 ICRP statement "if man is adequately protected, then other living things are also likely to be sufficiently protected" (NCRP 1991) is appropriate.

III. REVIEW PROCEDURES

The reviewer should take the following steps:

(1) Identify the exposure pathways for the biota not considered in the review in ESRP 5.4.1.

(a) Consider the exposure pathways to biota other than members of the public and determine if any of these pathways could be expected to result in estimated doses significantly greater than those evaluated by the reviewer for ESRP 5.4.3.

(b) If no such pathways can be identified, end the review and proceed to the "Evaluation Findings" of this ESRP.

(2) If exposure pathways for biota other than members of the public are identified for which significantly greater (1 m Gy/day) (100 rad/day) doses could be predicted, then consult with the appropriate reviewers for ESRP 2.4 to determine how the biota at these locations could be affected, and calculate doses to these biota, using models and procedures described in Volume 2, *Analytical Models and Calculations*, of the BEIR (1972) report.

- If the doses are of approximately the same order of magnitude or less than the dose criteria in 40 CFR 190, no further review is necessary.

- If significantly higher doses can be predicted, determine if these doses can be expected to affect species population stability. Make this determination through the review of appropriate literature, if available, and through consultation with authorities in the field of radiological effects to biota.

IV. EVALUATION FINDINGS

When the reviewer has determined that there will be no radiological impact of any significance on biota other than members of the public, a statement similar to the following should be used in the EIS:

> The staff reviewed the available information relative to the radiological impact on biota other than man. The staff concludes that no measurable radiological impact on populations of biota is expected from the radiation and radioactive material released to the biosphere as a result of the routine operation of the nuclear plant.

When the reviewer determines that there will be a significant impact on biota other than man that will affect the population stability, an input to the EIS should be prepared that describes (1) the doses and the biota affected, (2) the reviewer's analysis that identified the potential impact and the calculated doses, and (3) the staff assessment of alternatives that would mitigate or avoid the impact.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 20, "Standards for Protection Against Radiation."

10 CFR 20.1301, "Dose limits for individual members of the public."

40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

International Atomic Energy Agency (IAEA). 1992. *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation protection Standards*. Technical Reports Series No. 332. Vienna, Austria.

National Academy of Sciences, Committee on the Biological Effects of Ionizing Radiation (BEIR). 1972. *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation*. BEIR, National Research Council, Washington, D.C.

National Council on Radiation Protection and Measurements (NCRP). 1991. *Effects of Ionizing Radiation on Aquatic Organisms*. NCRP Report No. 109, Bethesda, Maryland.

U.S. Atomic Energy Commission (AEC). 1975. "Final Environmental Statement, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Practicable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," WASH-1258, USAEC, July 1975.

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5.5 ENVIRONMENTAL IMPACTS OF WASTE

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the environmental impacts of waste from station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.5.1 and 5.5.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for application of this criterion is as follows:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.5.1 and 5.5.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.5.1 NONRADIOACTIVE-WASTE-SYSTEM IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's assessment of impacts resulting from the discharge of nonradioactive effluents to the biosphere and to direct the staff's preparation of a summary of these impacts.

The scope of the review directed by this plan should include (1) identification of plant systems having nonradioactive effluent discharges, (2) summarization of the impacts of these systems that have been identified and assessed by other ESRP Chapter 5.0 reviewers, and (3) identification and assessment of nonradioactive waste system impacts not treated by other reviewers of ESRP Chapter 5.0.

The review should provide sufficient detail of nonradioactive wastes to assess and predict potential nonradioactive waste system impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 2.3.1 and 2.3.2. Obtain information on the site hydrology and water use for factoring into the analysis of waste effluents.
- ESRPs 3.6.1, 3.6.2, and 3.6.3. Obtain information on the chemical, biocide, sanitary, and other waste systems identified in ESRPs 3.6.1, 3.6.2, and 3.6.3.

- ESRPs 5.2.2 and 5.3.2.1. Obtain dilution factors and provide information on the impacts of nonradioactive effluent streams to the reviewer for ESRP 5.2.2.

- ESRP 5.3.2.2. Obtain information on chemicals discharged from the cooling system and their associated impacts.

- ESRP 5.8.1. Provide information about the effluent discharges that may impact the analysis of the physical factors affecting socioeconomics.

- ESRP 5.10. Provide a list of measures and controls to limit adverse impacts that are considered appropriate.

- ESRPs 6.4, 6.5.1, and 6.5.2. Provide a discussion of any requirements for preoperational monitoring programs that will be needed to establish baselines for evaluating operational nonradioactive waste system impacts.

- ESRP 6.6. Provide a characterization of the nonradioactive effluent streams that may require a chemical monitoring program.

- ESRP 10.1. Provide a summary of the unavoidable adverse environmental impacts that are predicted to occur as a result of nonradioactive waste system operation.

- ESRP 10.2. Provide a summary of irreversible and irretrievable commitments of resources that are predicted to occur as a result of nonradioactive waste system operation.

- Interface with Environmental Project Manager (EPM). Obtain input from the EPM on any adverse impacts identified from this review that are likely to require mitigation, and obtain input from the EPM on the practicality and benefit-cost balance of modifications and measures or alternative designs to minimize impacts.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of potential impacts. The following data or information should be obtained:

- descriptions of nonradioactive waste systems, including quantities, composition, and frequency of waste discharges to water, land, and air (from ESRP 3.6)

- for discharges to water, waste concentrations at the point of discharge, predicted dilution in the receiving water body, and estimates of concentrations at various distances from the discharge point (from the environmental report [ER] and from the ESRPs 3.6 and 5.3.2)

- ambient concentrations in the receiving water body of the chemicals and other materials contained in the waste discharges (from ESRPs 2.3.3 and 3.6)

- receiving water body water-quality criteria for domestic, industrial, agricultural, and recreational uses (from ESRP 2.3.3 and consultation with appropriate Federal, State, regional, local, and affected Native American tribal agencies)

- water use for the receiving water bodies (from ESRP 2.3.2)

- aquatic ecology for the receiving water bodies (from ESRP 2.4.2)

- for discharges to land (other than at licensed commercial waste disposal sites), size and location of disposal sites, quantity and composition of wastes, and method of disposal (e.g., burial, combustion, evaporation) (from the ER)

- terrestrial ecology at disposal sites other than licensed commercial sites (from ESRP 2.4.1)

- disposal site (other than licensed commercial sites) soils data, and potential for transport of wastes to ground and surface waters (from the ER)

- plans for ultimate treatment and/or restoration of retired disposal sites (other than licensed commercial sites) (from the ER)

- applicable Federal, State, regional, local, and affected Native American tribal criteria or standards for solid-waste disposal to land areas and for air quality (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- other site-specific waste-disposal activities (e.g., spoils from intermittent dredging activities) (from the ER)

- applicant's National Pollutant Discharge Elimination System (NPDES) permit and water quality certification or their status if not issued (from ESRP 1.2).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the evaluation of nonradioactive waste impacts are based on the relevant requirements of the following:

- 10 CFR 51.71(d) with respect to quantification of impacts and analysis of compliance with environmental quality standards and requirements

- 40 CFR 133 with respect to treatment of wastewater and sewage

- 40 CFR 423 with respect to effluent limitation guidelines on chemical and biocide discharges.

Numerous public laws have a bearing on the handling and disposal of nonradioactive wastes. The most relevant of these include the following:

- Solid Waste Disposal Act of 1965, which includes the Resource Conservation and Recovery Act of 1976, with respect to Federal, State, regional, local, and affected Native American tribal standards and regulations for disposal of solid wastes
- Fish and Wildlife Coordination Act of 1958
- Federal Water Pollution Control Act (FWPCA) Amendments of 1972 (as amended and now commonly referred to as the Clean Water Act [CWA])
- Marine Protection, Research, and Sanctuaries Act of 1972 (most recently amended 1994)
- Endangered Species Act of 1973 (amended 1988)
- Clean Air Amendments of 1970 and 1977 (most recently amended 1995)
- Memorandum of Understanding Between NRC and the Army Corps of Engineers, August 25, 1975
- Applicable Memoranda of Understanding Between State Governments and NRC.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to waste discharges and monitoring programs.

Technical Rationale

The technical rationale for evaluating the applicant's description of potential environmental impacts of waste is discussed in the following paragraphs:

A multitude of laws govern the treatment, discharge, or disposal of liquid and solid wastes and limit effluent levels into streams and other environments. The impacts of waste handling and disposal require evaluation to ascertain whether they will be within acceptable release limits and whether they could be responsible for unacceptable environmental impacts. If the evaluation of the waste streams suggests that levels would be unacceptable, alternative treatment or disposal methods should be identified.

For liquid discharged, the CWA regulations (40 CFR 100 and 40 CFR 400-501) delegate authority for the implementation of the NPDES, a required permit for plant operation, to the States. In States that have not accepted responsibility for the NPDES, consultations with EPA are required. These consultations with the State or EPA are a necessary part of the permitting process to determine criteria that must be met for issuance of this permit. Generally, a valid NPDES permit will meet the documentation requirements for ESRP reviews regarding discharges to the waters of the United States.

The Clean Air Act regulations (40 CFR 50-99) and the regulations implementing the Solid Waste Disposal Act (40 CFR 240-282) are both similar to the CWA in format with the delegation of authority to the States and EPA as the default regulator. Generally, whatever the permit, if the Federal, State, regional, local, and affected Native American tribal regulations have been met regarding discharges to the environment from the plant systems, then the documentation requirements of the ESRP will also be fulfilled.

Disposal of nonradioactive solid waste is governed by Solid Waste Disposal Act to ensure proper handling and final disposal. NPDES and mandated waste minimization programs further reduce quantities and ensure regulatory compliance.

III. REVIEW PROCEDURES

The analysis should be closely linked with the nonradioactive waste system descriptions provided by the reviewers of ESRP 3.6 and with the environmental descriptions provided by the reviewers of ESRP Chapter 2.0 to establish the nonradioactive waste treatment system characteristics and effluents that are most likely to result in adverse environmental impacts. The reviewer should consult with the reviewers for ESRPs 5.1.1, 5.2.2, and 5.3.2.2 as an initial step in establishing the scope of this analysis.

As a general rule, impacts affecting land use, water use, and aquatic biota will be covered by the reviewers for ESRPs 5.1.1, 5.2.2, and 5.3.2.2. This review should address impacts on terrestrial biota, air-quality impacts, water-use impacts not covered by the reviewer for ESRP 5.2.2 (e.g., sanitary waste system effluents), and any other nonradioactive waste system impacts identified in the consultation with the reviewers for ESRPs 5.1.1, 5.2.2, and 5.3.2.2, but not addressed by these reviewers.

The reviewer should follow the analysis procedures outlined in ESRPs 5.1.1, 5.2.2, and 5.3.2.2, depending on the nature of the impacts that could be expected. The reviewer should follow the general analysis procedure of ESRP 4.3.1 to analyze and evaluate impacts on terrestrial ecosystems. For land disposal of nonradioactive wastes, the reviewer should consider the potential for short- and long-term damage to terrestrial ecosystems, especially for movement of toxic chemical materials to groundwater, root uptake, and transfer to shoots and into food chains from both dry and liquid waste disposal to the ground. The reviewer should determine the nature and quantities of wastes to be disposed of by licensed waste disposal contractors, but will not assess the impacts of such disposals. The reviewer should prepare a list of all nonradioactive effluents (liquid, solid, and gaseous) and should assess the impacts of

those discharges not considered by other ESRP Chapter 5.0 reviewers. The reviewer may use the assessments prepared by other reviewers or by other Federal or State agencies when these are available. With these guidelines in mind, the reviewer should complete the following steps:

(1) Ensure that all potential impacts resulting from operation of nonradioactive waste systems have been addressed in this review or by other ESRP Chapter 5.0 reviewers.

(2) Ensure that the extent of compliance with Federal, State, regional, local, and affected Native American tribal effluent and receiving water standards (e.g., the CWA) has been assessed.

(3) Follow the evaluation procedures of ESRPs 4.3.1, 5.1.1, 5.2.2, and 5.3.2.2 to evaluate the identified potential impacts not addressed by other Chapter 5.0 reviewers. For terrestrial ecosystems, potential impacts that could require mitigation or avoidance include the following:

- disposal sites that preempt habitat critical to the survival of threatened or endangered species or preempt more than a few percent of "important" species' habitat on a regional basis

- disposal sites or discharge practices that permit toxic materials to contaminate ground or surface water or to be suspended and dispersed through the air.

(4) Evaluate the impact to determine whether waste minimization and/or pollution prevention have been considered and how their implementation could change the effect of the impact.

IV. EVALUATION FINDINGS

Input to the environmental impact statement (EIS) should describe in general terms the chemical and physical properties of wastes discharged from the nonradiological waste systems. Only significant discharges (in terms of quantity or toxicity) need to be described. Adverse impacts to ecosystems or to land and water use resulting from nonradioactive waste system operation should be described and quantified, along with a brief description of mitigating measures when measures and controls to limit adverse impacts have been identified. Adverse impacts that cannot be mitigated should be identified, and they should be referenced if alternatives to avoid these impacts have been identified.

Evaluation of each identified impact should result in one of the following determinations:

- *The impact is minor, and mitigation is not needed.* When all impacts are of this nature, the reviewer should include a statement in the environmental impact statement of the following type:

  The staff reviewed the available information on the operation of the nonradioactive-waste system. Based on this review, the staff concludes that there are no significant environmental impacts.

- *The impact is adverse, but can be mitigated by specific design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the EPM for verification that modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications, measures, and controls to limit the corresponding impact. Mitigation measures should be provided to the reviewer for ESRP 5.10. A statement similar to the following should be included in the EIS:

  > The staff reviewed the information on the operation of the nonradioactive waste system. Based on this review, the staff concludes that the following impacts require mitigation.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the EPM that an analysis and evaluation of alternative designs or procedures is needed. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should provide this information to the reviewer for ESRP 10.1. A statement similar to the following should be included in the EIS:

  > The staff reviewed the information on the operation of the nonradioactive waste system. Based on this review, the staff concludes that the following impact(s) cannot be mitigated and should be avoided. Alternatives should be considered.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.71, "Draft environmental impact statement—contents."

40 CFR 50-99 (the Clean Air Act regulations).

40 CFR 100 and 400-501 (the Clean Water Act regulations).

40 CFR 133, "Secondary Treatment Regulations."

40 CFR 240-282 (the Solid Waste Disposal Act regulations).

40 CFR 423, "Steam Electric Power Generating Point Source Category."

Clean Air Act Amendments of 1977, as amended, 41 USC 7401 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

Memorandum of Understanding between the Corps of Engineers, U.S. Army, and the U.S. Nuclear Regulatory Commission for the Regulation of Nuclear Power Plants," 40 *Federal Register* 37110 (1975).

Solid Waste Disposal Act, as amended, 42 USC 6901 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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5.5.2 MIXED WASTE IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's assessment of impacts resulting from the storage or disposal of mixed radioactive wastes and to direct the staff's preparation of a summary of these impacts. Mixed waste contains both hazardous waste and radioactive source, special nuclear, or byproduct material as defined in the Atomic Energy Act (AEA) of 1954 (42 USC 2011 et seq.).

The scope of the review directed by this plan should include the following:

- identification of plant systems producing mixed waste
- assessment of mixed waste storage plans, capabilities, and resulting impacts
- assessment of mixed waste disposal plans or capabilities.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to reviewers for the following ESRPs, as indicated:

- ESRP 3.5. Obtain a list of potential sources of mixed waste.

- ESRP 5.10. Provide a list of measures and controls to limit adverse impacts from the storage of mixed wastes that are to be considered in the licensing process.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- descriptions of systems that create mixed wastes, including quantities of waste produced (from the environmental report [ER], requested from the applicant, or from the reviewer for ESRP 3.5)

- anticipated disposal plans for the mixed wastes (i.e., disposal at a mixed waste disposal facility, shipment to a treatment facility, or storage onsite) (from the ER or requested from the applicant)

- estimated environmental impacts, including health effects resulting from exposure to the chemical constituents as well as those resulting from radiological exposures that are estimated to be received by workers as a result of mixed-waste testing and storage (from the ER or requested from the applicant)

- a waste minimization plan that identifies process changes that can be made to reduce or eliminate mixed wastes. This should contain a description of methods to minimize the volume of mixed wastes (from the ER or requested from the applicant).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the analysis and evaluation of the impacts resulting from the production, storage, and disposal of mixed waste are based on the following:

- Resource Conservation and Recovery Act of 1976 (RCRA) with respect to mixed waste, which must meet EPA's requirements for hazardous waste in 40 CFRs 261, 264, and 265 before final transfer offsite in route to burial. This includes the maintenance of records identifying each physical location or unit where mixed waste is stored and identifying the method of storage (40 CFR 264.73(b) and 265.73(b)). An inspection of these storage areas for compliance with applicable RCRA standards for storage methods, including an assessment of compliance with storage-facility standards of 40 CFR 264 or 265 (interim status), should be performed regularly (see 40 CFR 264.15 and 265.15).

- 10 CFR 20 with respect to the NRC requirements for general radiation protection and occupational dose limits, and waste disposal requirements.

Technical Rationale

The technical rationale for evaluating the applicant's potential mixed-waste impacts is discussed in the following paragraphs:

Mixed waste is generated during routine maintenance activities, refueling outages, health physics activities, and radiochemical laboratory activities. The vast majority of mixed waste that is stored at nuclear power plants is chlorinated fluorocarbons (CFCs) and waste oil. Other sources include liquid scintillation fluids, other types of organic materials, and metals, including lead and chromium and aqueous corrosives (NRC 1996).

Mixed waste is commonly stored onsite due to the lack of treatment and disposal sites. For this reason, impacts resulting from the chemical hazards and occupational exposures to radioactive material may be somewhat higher than would otherwise be expected. In addition, occupational chemical and radiological exposures may occur during the testing of mixed wastes to determine if the constituents are chemically hazardous.

III. REVIEW PROCEDURES

Facility owners/operators are required by RCRA regulations to maintain sufficient information to identify their mixed wastes. The information required includes RCRA waste codes for the hazardous components, the source of the hazardous constituents, a discussion of how the waste was generated, the generation rate and volumes of mixed waste in storage, and any information used to identify mixed wastes or make determinations that the wastes are prohibited by land disposal restrictions. Each owner/operator is required (under RCRA regulations) to develop a waste minimization plan that identifies process changes that can be made to reduce or eliminate mixed wastes, methods to minimize the volume of regulated wastes through better segregation of materials, and the substitution of nonhazardous materials.

The reviewer should take the following steps to assess the applicant's plans or capabilities for mixed waste disposal:

(1) Ensure that the waste minimization plan includes a schedule for implementation, projections of volume reductions to be achieved, and assumptions that are critical to the accomplishment of projected volume reductions.

(2) Review the nature and quantities of mixed wastes to be disposed of or that must be stored onsite.

(3) Assess what, if any, environmental impacts (both radiological and nonradiological) would result from storage of the mixed wastes.

(4) Compare impacts resulting from occupational dose related to the storage of mixed wastes with the occupational dose limit criteria given in 10 CFR 20.

(5) Ensure that the applicant has anticipated a method for disposal, treatment, or storage of the mixed wastes.

(6) Ensure that a mixed waste minimization plan has been formulated and that it identifies changes that can be made to reduce or eliminate mixed wastes.

IV. EVALUATION FINDINGS

Input from this ESRP review to the environmental impact statement (EIS) should describe in general terms the nature and quantities of mixed waste that will be produced at the plant and the anticipated methods for disposal, treatment, and storage of the mixed waste. Adverse impacts to ecosystems, offsite populations, or workers from radiological and nonradiological exposures resulting from onsite storage of the mixed waste should be described and quantified, along with a brief description or reference to the staff's analyses that identified the impacts. Mitigating measures may be discussed, and reference should be made to ESRP 5.10 when measures and controls to limit adverse impacts have been assessed. Adverse impacts that cannot be mitigated should be identified, and ESRP 9.4 should be referenced if alternatives to avoid these impacts have been identified.

Evaluation of each identified impact should result in one of the following determinations:

- *The impact is minor, and mitigation is not required.* When all impacts are of this nature, the reviewer should accept the quantities and methods of storage or disposal of the mixed waste, and a statement of the following type should be included in the EIS:

  > The staff reviewed the available information on mixed waste generated at the plant. Based on this review, the staff concludes that there are no significant environmental impacts.

- *The impact is adverse, but can be mitigated by specific design or procedure modifications that the reviewer has identified and determined to be practical.* In these cases, a statement similar to the following should be included in the EIS:

  > The staff reviewed the information on the mixed-waste system. Based on this review, the staff concludes that the following impacts require mitigation.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should provide this information to the reviewer for ESRP 10.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 20, "Standards for Protection Against Radiation."

40 CFR 261, "Identification and Listing of Hazardous Waste."

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities."

40 CFR 264.73, "Operating record."

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities."

40 CFR 265.73, "Operating record."

Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq.

Resource Conservation and Recovery Act of 1976, as amended, 42 USC 6901 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vol. 1, Washington, D.C.

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5.6 TRANSMISSION SYSTEM IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the environmental impacts of the transmission during system station operation. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 5.6.1 through 5.6.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's environmental impacts of the transmission system is described in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.6.1 through 5.6.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.6.1 TERRESTRIAL ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and evaluation of impacts on the terrestrial ecosystem induced by the operation and maintenance of transmission systems. The scope of the review directed by this plan should normally consider effects of rights-of-way maintenance and usually should be limited to an assessment of impacts to "important" terrestrial species and habitats (defined in Table 2.4.1-1) other than humans. Impacts associated with the physical presence of the transmission towers and wires are analyzed in ESRP 4.1.3. The review for this ESRP should predict impacts to terrestrial resources and evaluate the significance of such impacts. Where necessary, the reviewer should evaluate alternative practices or procedures to mitigate the predicted impacts. Both aerial and underground transmission systems should be considered in this review.

Review Interfaces

The reviewer for this ESRP should obtain inputs from and provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.2.2. Obtain information about the transmission corridors and offsite areas in sufficient detail to determine where impacts to the terrestrial resources from transmission system operation and maintenance could occur.

- ESRP 2.4.1. Obtain information about the terrestrial environment in the vicinity of the transmission corridor in sufficient detail to determine what species, habitats, or ecosystems could be affected by transmission system operation and maintenance.

- ESRP 3.7. Obtain information on physical characteristics of the station's power transmission systems and maintenance procedures in sufficient detail to determine impacts to terrestrial biota from the transmission system.

- ESRP 4.3.1. Obtain information on impacts of transmission system construction to terrestrial biota from the reviewer of ESRP 4.3.1.

- ESRP 5.10. Provide a list of those measures and controls to limit adverse transmission system impacts that may be considered in the licensing process and a list of applicant commitments to limit these impacts.

- ESRP 6.5.1. Provide a discussion of any preoperational monitoring programs that will be needed to establish a baseline for evaluating operational and maintenance impacts.

- ESRP 9.4.3. Provide a list of adverse transmission system impacts that could be avoided or mitigated through alternative designs or maintenance procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable biotic impacts that are predicted to occur as a result of transmission system operation and maintenance.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- maintenance practices, such as use of chemical herbicides, roadway maintenance, and mechanical clearing, that are anticipated to affect terrestrial biota, including sensitive agricultural crops (from the environmental report [ER])

- special maintenance practices used in important habitats (e.g., marshes, natural areas, bogs), including those that result in unique beneficial effects on specific terrestrial biota (from the ER and from consultations with Federal, State, regional, local, and affected Native American tribal agencies)

- wildlife-management practices (from the ER and the State wildlife agency)

- a summary of consultations with appropriate Federal, State, regional, local, and affected Native American tribal agencies regarding potential impacts to terrestrial biota resulting from transmission system operation and maintenance (from the ER)

- additional information requested in ESRPs 2.4.1 and 3.7 for reviewing impacts on terrestrial resources from transmission system operation and maintenance.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of impacts on terrestrial ecology as a result of transmission system operation and maintenance are relevant requirements of the following:

- 10 CFR 51.45 with respect to ERs and the analysis of potential impacts contained therein
- 10 CFR 51.75 with respect to analysis of impacts to the terrestrial environment affected by the issuance of a construction permit
- 10 CFR 52, Subpart A, with respect to analysis of impacts to the terrestrial environment affected by the issuance of an early site permit
- 10 CFR 51.95 with respect to the preparation of supplemental environmental impact statements (EISs) in support of the issuance of an operating license
- Bald and Golden Eagle Protection Act with respect to the prohibition of taking, possessing, selling, transporting, importing, or exporting a bald or golden eagle, dead or alive, without a permit
- Coastal Zone Management Act of 1972 with respect to natural resources and land or water uses of the coastal zone
- Endangered Species Act of 1973 with respect to identifying threatened and endangered species and critical habitats and initiating formal or informal consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service
- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources in the planning and development of projects that affect water resources
- Migratory Bird Treaty Act with respect to declaring that it is unlawful to take, import, export, possess, buy, sell, purchase, or barter any migratory bird. Feathers and other parts, such as nests or eggs, and products made from migratory birds are also covered by the Act. "Take" is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, trapping, or collecting.

Regulatory guidance and specific criteria to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance for the preparation of ERs. With respect to the transmission system, it specifies the provisions of descriptions of effects on plants and wildlife habitat from maintenance

of transmission line rights-of-way and access roads. It also states that potential impacts of electric or magnetic fields be discussed. The reviewer should ensure that the appropriate data and analyses are provided in the ER and included in the EIS.

- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (NRC 1977), contains technical information for the design and execution of terrestrial environmental studies, the results of which may be appropriate for inclusion in the EIS. The reviewer should ensure that the appropriate information regarding effects on terrestrial biota from operation and maintenance of the transmission systems is provided in the ER and included in the EIS.

Technical Rationale

The technical rationale for evaluating the applicant's potential impacts to the terrestrial ecosystem from the transmission systems is discussed in the following paragraph:

> The EIS needs to include an analysis that considers and balances the environmental effects of the transmission system on the terrestrial environment and the alternatives for reducing or avoiding adverse environmental effects, as well as any environmental benefits that may result from the proposed action. Following the acceptance criteria listed above will help ensure that the environmental impacts of the transmission system on the terrestrial environment will be considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

To evaluate the impacts on terrestrial ecology from transmission-system operation and maintenance, the reviewer should take the following steps:

(1) identify the operational and maintenance activities associated with transmission facilities that could impact "important" terrestrial species and habitats.

- Potential adverse impacts resulting from operation and maintenance activities include soil erosion, runoff or uncontrolled release of defoliants and herbicides, barriers to wildlife movements created by clear-cutting of trees, and subtle effects of high energy electrical fields on the behavior of animals.

- Electric field effects on terrestrial biota need not be considered for lines energized at less than 765 kV. Also, experience has shown that for transmission lines energized at 765 kV or less, there are no known adverse impacts resulting from ozone formation. At voltages of 765 kV or above, consideration of the possible effects of electric fields and corona discharge, including resulting noise on terrestrial biota, may be warranted. The presence of the towers and wires may affect wildlife use of nearby important habitats and flyways (see ESRP 4.3.1 for the analysis of potential bird collisions with towers and wires).

- The potential for bird electrocution is considered negligible for the high voltage transmission systems considered in this review.

(2) Create an inventory of the "important" species and habitats affected by the operation and maintenance practices discussed above.

(3) Estimate the overall impact of operation and maintenance of the transmission lines and corridors on "important" species and habitats. Include in the analysis a consideration of whether the operation and maintenance of transmission lines and corridors will result in impacts to terrestrial biota that should be mitigated or avoided.

(4) Determine whether the proposed operation and maintenance procedures are those generally recognized as environmentally responsible. Following are examples of such procedures:

- maintaining ground cover in rights-of-way to avoid runoff and siltation
- avoiding the use of herbicides and defoliants near waterways and using only licensed herbicide and/or pesticide applicators
- burying underwater transmission lines
- avoiding unnecessary removal of vegetation that shades streams.

(5) Become familiar with the provisions of standards and guides pertinent to the operation and maintenance of transmission lines and corridors. Although, for the most part, these documents do not provide quantitative information by which the reviewer can judge acceptance, they will serve to point out good maintenance practices.

(6) Provide a summary of consultations with appropriate Federal, State, regional, local, and affected Native American tribal agencies.

IV. EVALUATION FINDINGS

Input to the EIS should include (1) a list of adverse impacts of transmission system operation and maintenance to terrestrial ecosystems, (2) a list of the impacts for which there are measures or controls to limit adverse impacts and the associated measures and controls, (3) the applicant's commitments to limit these impacts, and (4) the staff's evaluation of the adequacy of the applicant's measures and controls to limit adverse impacts. This information should be summarized for the reviewer of ESRP 5.10.

Staff evaluations of mitigating measures may be discussed, and reference should be made to ESRP 5.10 when measures and controls to limit adverse impacts have been listed by the reviewer. Adverse impacts that cannot be mitigated should be identified, and ESRP 9.4.3 should be referenced if alternatives to avoid these impacts have been identified.

If the reviewer verifies that sufficient information has been provided in accordance with the guidelines of this ESRP section, then the evaluation supports the following type of concluding statement to be included in the staff's EIS:

> The staff reviewed the available information on impacts to the terrestrial ecology. The staff concludes that the list and description of impacts is adequate to comply with 10 CFR 51.45.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, Subpart A, "Early Site Permits."

Bald and Golden Eagle Protection Act of 1940, as amended, 16 USC 668 et. seq.

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Migratory Bird Treaty Act, as amended, 16 USC 703 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Terrestrial Environmental Studies for Nuclear Power Stations*. Regulatory Guide 4.11, Rev. 1, Washington, D.C.

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5.6.2 AQUATIC ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification, quantification, and evaluation of the impacts of transmission facility operation and maintenance on "important" aquatic species and habitats (defined in Table 2.4.2-1). The review should include consideration of the aquatic impacts of the operation and maintenance of transmission lines and corridors, substations, and switchyards in sufficient detail to allow the reviewer to assess the magnitude of potential impacts. When adverse impacts of sufficient magnitude are identified, the reviewer should evaluate alternative operating and maintenance practices to mitigate or avoid environmental impacts.

This review will be initiated only when the reviewer for ESRP 2.4.2 determines that there are aquatic environments that could be impacted by transmission system operation or maintenance.

Review Interfaces

The reviewer for this ESRP should obtain inputs from and provide inputs to reviewers for the following ESRPs, as indicated:

- ESRP 2.2.2. Obtain information about the transmission corridors and offsite areas in sufficient detail to determine where impacts to aquatic ecosystems from transmission system operation and maintenance could occur.

- ESRP 2.4.2. Obtain information about unique aquatic habitats, including critical habitat for threatened and endangered species in the vicinity of the transmission corridors.

- ESRP 3.7. Obtain information regarding the physical characteristics of power transmission systems and maintenance procedures necessary for determining environmental impacts on the aquatic ecosystem.

- ESRP 4.3.2. Obtain information on impacts of transmission construction on aquatic resources.

- ESRP 5.2.1. Obtain a list of hydrological alterations that will take place along the transmission corridor and that could potentially impact the aquatic ecosystem.

- ESRP 5.10. Provide a list of recommended measures and controls to limit adverse impacts of the transmission system on the aquatic system and list applicant commitments to limit these impacts.

- ESRP 6.5.2. Provide a list of preoperational monitoring programs to obtain baseline data for subsequent operational monitoring programs.

- ESRP 9.4.3. Provide advice when alternative transmission system maintenance may be needed and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a list of unavoidable adverse impacts of transmission system maintenance.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information will be needed only when aquatic habitats that may be affected by the operation or maintenance of the transmission system have been identified by the reviewer for ESRP 2.4.2:

- a description of and map showing any "important" aquatic species or habitats in the vicinity of proposed transmission facilities (from ESRP Section 2.4.2, and from the applicant on request)

- physical, chemical, and biological factors known to influence distribution and abundance of aquatic life in the identified unique habitats (from the general literature)

- endangered and threatened species that are known or expected to be present, together with any specific habitat requirements or community interrelationships (from the ESRP for EIS Section 2.4.2)

- maintenance practices that are anticipated to adversely affect aquatic biota (from the environmental report [ER] and the general literature)

- licensee commitments on maintenance practices.

- a summary of consultations with appropriate Federal, State, regional, local, and affected Native American tribal agencies regarding potential impacts to aquatic biota resulting from transmission system operation (from ER).

Additional background information about the aquatic ecology around the transmission system, necessary for this review of impacts on aquatic resources from operation and maintenance of the transmission system, is requested in ESRP 2.4.2 and can be found in the ER, general literature, and from consultation with Federal, State, regional, local, and affected Native American tribal agencies.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of impacts to aquatic ecology as a result of transmission system operation and maintenance are the relevant requirements of the following:

- 10 CFR 51.45 with respect to ERs and the analysis of potential impacts contained therein
- 10 CFR 51.75 with respect to analysis of impacts to the aquatic environment affected by the issuance of a construction permit
- 10 CFR 52, Subpart A, with respect to analysis of impacts to the aquatic environment affected by the issuance of an early site permit
- 10 CFR 51.95 with respect to the preparation of supplemental environmental impact statements (EISs) in support of the issuance of an operating license
- Coastal Zone Management Act of 1972 with respect to natural resources and land or water uses of the coastal zone
- Endangered Species Act of 1973 with respect to identifying threatened and endangered species and critical habitats and initiating formal or informal consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service
- The Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, with respect to restoration and maintenance of the chemical, physical, and biological integrity of water resources
- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources in the planning and development of projects that affect water resources
- Rivers and Harbors Appropriations Act of 1899 with respect to the deposition of debris in navigable waters or tributaries to such waters.

Regulatory guidance and specific criteria to meet the regulations and other statutory requirements identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance for the preparation of ERs. With respect to the transmission corridors, it specifies that discussions of temporary or permanent changes in the biological processes of plants and wildlife in the vicinity of the transmission corridors, which result from construction of new access roads or changes in the use of herbicides or pesticides, be addressed in the ER. The reviewer should ensure that the appropriate data and analyses are provided in the environmental report and are included in the EIS.

Technical Rationale

The technical rationale for evaluating the applicant's potential impacts to aquatic ecosystems is discussed in the following paragraph:

The EIS needs to include an analysis that considers and balances the environmental effects of the transmission system on the aquatic environment and the alternatives for reducing or avoiding adverse environmental effects, as well as any environmental benefits that may result from the proposed action. Following the acceptance criteria listed above will help ensure that the environmental impacts of the transmission system on the aquatic environment will be considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

To evaluate the impacts to aquatic ecosystems from transmission facility operating and maintenance, the reviewer should take the following steps:

(1) Identify operational and maintenance activities associated with transmission facilities and consider those that could adversely affect those "important" aquatic species and habitats identified by the reviewer for ESRP 2.4.2.

- The resources to be considered include marshlands, wetlands, impoundments, and water bodies.

- Potential impacts on these resources include heating of water bodies from removal of shade trees, siltation and turbidity resulting from increased runoff and erosion, runoff of defoliants and herbicides, recreational access by the public, and high energy electrical fields associated with underwater transmission facilities.

(2) Consult with the reviewer for ESRP 5.2.1 for any needed hydrological data. When potential impacts are anticipated

- inventory the "important" aquatic species or habitats vulnerable to the identified operation and maintenance practices

- predict the environmental impacts on these aquatic species and habitats.

(3) Compare proposed transmission system operation and maintenance with the provisions of standards and guides pertinent to the operation and maintenance of transmission facilities and corridors.

(4) Determine whether the proposed operation and maintenance procedures are those generally recognized as environmentally responsible. Following are examples of such procedures:

- maintaining ground cover in rights-of-way to avoid runoff and siltation

- avoiding the use of herbicides and defoliants near waterways and using only licensed herbicide and/or pesticide applicators

- burying underwater transmission lines

- avoiding unnecessary removal of vegetation that shades streams.

(5) Provide a summary of consultations with appropriate Federal, State, regional, local, and affected Native American tribal agencies.

IV. EVALUATION FINDINGS

When no aquatic habitats have been identified, the input to the EIS should consist of only a statement to that effect. When such habitats have been identified, this section of the EIS should accomplish the following objectives: (1) public disclosure of aquatic impacts resulting from operation and maintenance of the transmission system, (2) presentation of the basis for the staff analysis, and (3) presentation of staff conclusions for operation and maintenance of the transmission system to minimize or avoid impacts on aquatic ecosystems. The following information should be included:

- a description of the transmission facilities, substations, switching yards, corridors, and rights-of-way to be operated and maintained, as they relate to aquatic impact, by reference to ESRP 3.7. Management practices should be described.

- a description of "important" aquatic species and habitats and their life stages found in or near the transmission facilities locations, by reference to ESRP 2.4.2

- an assessment of the impact on "important" aquatic species and habitats for the proposed transmission system maintenance procedures. When adverse impacts of sufficient magnitude have been identified, the input should include potential mitigating actions or alternative practices to limit or avoid the impacts. This information should be provided to the reviewer of ESRP 5.10.

If the reviewer verifies that sufficient information has been provided in accordance with the guidelines of this ESRP, then the evaluation supports the following type of concluding statement to be included in the staff's EIS:

> The staff reviewed the available information on impacts to the aquatic ecology. The staff concludes that the list and description of impacts is adequate to comply with 10 CFR 51.45.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, Subpart A, "Early Site Permits."

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Rivers and Harbor Appropriation Act, as amended, 33 USC 401 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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5.6.3 IMPACTS TO MEMBERS OF THE PUBLIC

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and evaluation of impacts on members of the public induced by operation and maintenance of the proposed transmission system. The scope of the review directed by this plan should include (1) operational impacts resulting from basic systems design parameters and proposed operating procedures and (2) maintenance practices affecting visual impacts.

The review should be in sufficient detail to predict and assess potential impacts and to evaluate how these impacts will be treated in the licensing process. Where necessary, the reviewer should consider alternative designs, practices, or procedures that would avoid or mitigate the predicted adverse impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.2.2. Obtain topographic maps or aerial photographs showing the proposed corridor or corridors.

- ESRP 3.7. Obtain input on the basic electrical design parameters, the basic structural parameters, and the maximum electric field gradient(s) and edge of right-of-way field gradients in kV/m.

- ESRP 5.10. Provide a list of measures and controls to limit adverse impacts of the power transmission system.

- ESRP 9.4.3. Provide a list of adverse environmental impacts that could be avoided or mitigated through alternative transmission system routes, designs, operational procedures, or maintenance practices and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable adverse environmental impacts that are predicted to occur as a result of transmission system operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- basic electrical design parameters, including transmission voltages, line capacity, conductor type, conductor configuration and spacing, and minimum design conductor clearances over open fields, main highways, primary and secondary roads, waterways, and railroads (from the environmental report [ER] and from ESRP 3.7)

- basic structural design parameters, including illustrations and descriptions of towers, conductors, and other structures, with dimensions, materials, color, and finish (from ESRP 3.7)

- description of maintenance practices used to reduce visual impacts (e.g., retention of vegetation buffer zones along roads) (from the ER)

- description of practices used to increase visibility for aircraft. Tower height is regulated to provide a safety factor for aircraft and to reduce the aesthetic impact of the transmission facilities. Marking of elevated structures is also a safety feature required to alert aircraft of structures to avoid.

- maximum predicted electric field gradient(s) and edge of right-of-way field gradients in kV/m (from ESRP 3.7)

- topographic maps (15-min. scale as a rule) or aerial photographs showing the proposed corridor or corridors (from ESRP 2.2.2 or on request from the applicant)

- the proposed means to reduce impacts to radio and television reception and to other communication systems (from the ER)

- the proposed grounding procedures for stationary objects along the rights-of-way (from the ER)

- design parameters for reducing electric shock potentials to moving vehicles, such as school buses and tractor trailers (from the ER)

- maximum predicted noise levels at the edge of rights-of-way resulting from transmission system operation, and the bases for these predictions (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of transmission system impacts on man are based on the relevant requirements of the following:

- 10 CFR 51.53(c)(3)(ii)(H) with respect to assessing shock hazard impacts of transmission systems.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), identifies the level of detailed description needed to evaluate impacts from land use, the construction and maintenance of these structures and their rights-of-way, and potential hazards to aerial navigation

- National Electrical Safety Code (NESC) (1997) with respect to shock hazards.

Technical Rationale

The technical rationale for evaluating the applicant's potential impacts to members of the public from operation and maintenance of the proposed transmission system is discussed in the following paragraphs:

Electric power is transferred through transmission systems from the nuclear facility in which it is generated to the power grid through which it is transmitted to the users. Impacts on members of the public resulting from the operation and maintenance of the proposed transmission system may occur as a result of corridor maintenance procedures, visual aspects, noise, electrostatic effects, or electromagnetic effects.

Evaluating the adequacy of this material addressing potential impacts requires that data on the power transmission system are sufficient to predict the overall impact of operation and maintenance activities on the transmission lines and corridors to the public.

III. REVIEW PROCEDURES

This procedure applies to the review of applications for construction permits, operating licenses, and combined licenses.

The reviewer's analysis of the proposed power-transmission system should be closely linked with the environmental review for ESRP 3.7 in order to establish the general transmission characteristics that are most likely to result in environmental impacts. The analysis should be governed by the magnitude of potential impacts on members of the public. The reviewer should coordinate this review with the reviewer for ESRP 5.6.1 to avoid duplication of effort. With the preceding guidelines in mind, the reviewer should take the following steps:

(1) Become familiar with the provisions of standards and guides pertinent to the operation and maintenance of transmission lines and corridors, including applicable State standards. Compare predicted noise levels with applicable State noise limits for residential areas and for other types of land use. The authority for environmental noise control was given to the States in the 1972 Noise Control Act.

(2) Identify the operational and maintenance activities associated with transmission facilities having impacts on man and determine whether the proposed operational parameters and maintenance procedures are those generally recognized as environmentally acceptable.

Potential adverse impacts resulting from operation and maintenance activities include electric shock hazard and electromagnetic field effects, corona discharges (including resultant noise), and potential visual impacts (e.g., design parameters and maintenance activities affecting visual impacts at major road crossings, areas of significant ridges, and concentrated human settlement). For transmission lines energized at 765 kV or less, experience has shown that there are no known adverse impacts resulting from ozone formation.

(3) Check for conformance with the National Electric Safety Code (NESC 1997), which provides design criteria that limit hazards from steady-state currents. Adherence to the NESC design criteria limits the short-circuit current to ground, produced by the largest anticipated vehicle or object, to less than 5 mA.

The chronic effects of exposure to electric and magnetic fields have been under investigation for some time. Although some of the recent studies suggest that the effects, if they exist, are below measurable levels, conclusions regarding this potential hazard are premature. If a scientific consensus is reached about these fields, the NRC may request that the applicant address this issue and the staff review the potential impacts on the public.

IV. EVALUATION FINDINGS

Provide an assessment of the impacts on members of the public resulting from transmission system operation and maintenance procedures, including the degree of noise impacts, if any. This assessment should include grounding procedures, applicable design features proposed for the reduction of shock potential, and corridor maintenance procedures to mitigate visual impacts. The presentation of this assessment should be based on (1) the extent by which the predicted impacts exceed criteria for acceptable levels and (2) potential electric and electromagnetic field effects.

Evaluation of each identified impact should result in one of the following conclusions:

- *The impact is minor, and mitigation is not required.* When impacts are of this nature, the reviewer should provide the following types of input to the EIS:

  The staff reviewed the available information relative to the impacts of the facility's transmission system. The staff concludes that the operational impacts and impacts from maintenance practices will be minor, and mitigation is not required.

- *The impact is adverse, but can be mitigated by specific design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the Environmental Project Manager (EPM) and the reviewer for ESRP 9.4.3 for verification that the modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications, measures, and controls to limit the corresponding impact. These lists should be provided to the reviewer for ESRP 5.10.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the reviewer of ESRP 9.4.3 that an analysis and evaluation of alternative designs or procedures is needed. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should provide this information to the reviewer for ESRP 10.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.53(c)(3)(ii)(H), "Postconstruction environmental reports."

Institute of Electrical and Electronic Engineers, Inc. 1997. *National Electrical Safety Code* (NESC). New York.

Noise Control Act, as amended, 42 USC 4901 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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5.7 URANIUM FUEL CYCLE IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review to comply with 10 CFR 51.51,[a] "Uranium fuel cycle environmental data - Table S-3," as the basis for the staff's evaluation of the environmental effects of the uranium fuel cycle.

Review Interfaces

The reviewers for this ESRP should obtain input from and provide input to reviewers for the following ESRP:

- ESRP 10.4.2. Provide a statement, if appropriate, that the environmental impacts of the uranium fuel cycle, as given in Table 5.7-A-1 and in relationship to the proposed project, appear to have little significance and would not alter the overall benefit-cost balance.

(a) The table has been further updated to reflect the changes contained in Attachment A to the Fuel Cycle Rulemaking Hearing Board's Conclusions and Recommendations of the Hearing Board Regarding the Environmental Effects of the Uranium Fuel Cycle, Docket No. RM 50-3, dated October 26, 1978 (NRC 1996).

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained.

- Table S-3 of Paragraph (a) of 10 CFR 51.51. The current amendment (as given in 49 FR 9381, March 12, 1984 and 49 FR 10922, March 23, 1984) is included in Appendix A to this ESRP as Table 5.7-A-1.[(a)]

The reviewer should ensure that the most recent amendment of Table S-3 has been provided as input to the EIS and should update the staff analysis given in Appendix A to this ESRP when necessary. The reviewer should also ensure that all conclusions given in Appendix A are appropriate for the proposed project.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the evaluation of the impacts of the uranium fuel cycle are based on the relevant requirements of the following:

- Paragraph (a) of 10 CFR 51.51, "Uranium fuel cycle environmental data—Table S-3" (*Federal Register* Notices 49 FR 9381, March 1984, and 49 FR 10922, March 23, 1984) with respect to the impacts to the environment from the hazards associated with the fuel cycle.

Technical Rationale

Appendix A provides a summary of the technical rationale for evaluating the applicant's potential uranium fuel cycle impacts. NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (NRC 1996) provides a more detailed analysis of the environmental impacts from the uranium fuel cycle. Although NUREG-1437 is specific to the impacts as they relate to license renewal, most of the information can also be applied to this ESRP review.

III. REVIEW PROCEDURES

No analysis of these data is required.

(a) The table has been further updated to reflect the changes contained in Attachment A to the Fuel Cycle Rulemaking Hearing Board's Conclusions and Recommendations of the Hearing Board Regarding the Environmental Effects of the Uranium Fuel Cycle, Docket No. RM 50-3, dated October 26, 1978 (NRC 1996).

IV. EVALUATION FINDINGS

Appendix A to this plan provides the input from this ESRP to be used in the environmental impact statement (EIS). In addition, the reviewer should ensure that, if appropriate, a statement similar to the following is included as input to ESRP 10.4.2:

> The staff evaluated the environmental impacts of the uranium fuel cycle as given in Table 5.7-A-1. The staff found these impacts to be sufficiently small so that when they are added to the other environmental impacts predicted for the proposed project, the fuel cycle impacts would not alter the overall benefit-cost balance.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulator Functions.

10 CFR 51.20, "Criteria for and identification of licensing and regulatory actions requiring environmental impact statements."

10 CFR 51.51, "Uranium fuel cycle environmental data."

42 FR 13803. March 14, 1984. Interim rule regarding the environmental considerations of the uranium fuel cycle. *Federal Register.*

43 FR 15613. April 14, 1978. Table S-3 of Paragraph (e) of 10 CFR 51.20 was amended. *Federal Register.*

49 FR 9381. March 1984. Notice. *Federal Register.*

49 FR 10922. March 23, 1984. Notice. *Federal Register.*

Evans, J. S., S. Abrahamson, M. A. Bender, B. B. Boecker, E. S. Gilbert, and B. R. Scott. 1993. *Health Effects Models for Nuclear Power Plant Accident Consequence Analysis.* Part I. Rev. 2. Introduction, Integration, and Summary. NUREG/CR-4214. Office of Nuclear Regulatory Research, Washington, D.C.

U.S. Atomic Energy Commission (AEC). 1974. *Environmental Survey of the Uranium Fuel Cycle.* WASH-1248, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*, NUREG-0116 (Supplement 1 to WASH-1248), Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*, NUREG-0216 (Supplement 2 to WASH-1248), Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1978. Attachment A to the Fuel Cycle Rulemaking Hearing Board's Conclusions and Recommendations of the Hearing Board Regarding the Environmental Effects of the Uranium Fuel Cycle, Docket No. RM 50-3.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Vol. 1, Washington, D.C.

APPENDIX A

INPUT TO THE ENVIRONMENTAL IMPACT STATEMENT

On March 14, 1977, the Commission presented in the *Federal Register* (42 FR 13803) an interim rule regarding the environmental considerations of the uranium fuel cycle. It was effective through September 13, 1978, and revised Table S-3 of Paragraph (e) of 10 CFR 51.20. In a subsequent announcement on April 14, 1978 (43 FR 15613), the Commission further amended Table S-3 to delete the numerical entry for the estimate of radon releases and to clarify *that the table does not cover health effects*. Further revision to 10 CFR 51 was made in 1984. The current requirement for Table S-3 is in 10 CFR 51.51 (49 FR 9381, March 12, 1984, and 49 FR 10922, March 23, 1984). The revised table is shown here as Table 5.7-A-1. The current rule reflects new and updated information on reprocessing spent fuel and radioactive-waste management as discussed in NUREG-0116, *Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle* (NRC 1976) and NUREG-0216, *Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle* (NRC 1977) which presents staff responses to comments on NUREG-0116. The rule also considers other environmental factors of the uranium fuel cycle, including aspects of mining and milling, isotopic enrichment, fuel fabrication, and management of low- and high-level wastes. These are described in the AEC report WASH-1248 (AEC 1974).

Specific categories of natural resource use are included in Table S-3 of the rule. These categories relate to land use, water consumption and thermal effluents, radioactive releases, burial of transuranic and high- and low-level wastes, and radiation doses from transportation and occupational exposures. The contributions in Table S-3 for reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle); that is, the cycle that results in the greater impact is used. The uranium fuel cycle is defined as the total of those operations and processes associated with provision, utilization, and ultimate disposition of fuel for nuclear-power reactors. Originally, two fuel cycle options were considered, which differed in the treatment of spent fuel removed from a reactor. "No recycle" treats all spent fuel as waste to be stored at a Federal waste repository; "uranium only recycle" involves reprocessing of spent fuel to recover unused uranium and return it to the system. Neither cycle involves the recovery of plutonium.

Since there is no longer any consideration of reprocessing spent fuel, only the no-recycle option is considered here. It is schematically presented in Figure 5.7-A-1. Natural uranium is mined in either open-pit or underground mines. The ore is transferred to mills where it is processed to produce uranium oxide or "yellow-cake." A conversion facility prepares the uranium oxide from the mills for enrichment by converting it to uranium hexafluoride (UF_6), which is then processed to separate the relatively nonfissile isotope U-238 from the more fissile isotope U-235. At a fuel-fabrication facility, the enriched uranium, approximately 3% U-235, is then converted to UO_2. The UO_2 is pelletized, sintered, and inserted into tubes to form fuel assemblies. The fuel assemblies are placed in the reactor to produce power. When the content of the U-235 reaches a point where the nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are withdrawn from the reactor. After onsite

storage for sufficient time to allow for short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies will be transferred to a Federal repository for interment. Disposal of spent-fuel elements in a repository constitutes the final step in the no-recycle option.

The following assessment of the environmental impacts of the fuel cycle as related to the operation of the proposed project is based on the values given in Table S-3 and the staff's analysis of the radiological impact from radon releases. NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NRC 1996) provides a very detailed analysis of the environmental impacts from the uranium fuel cycle. Although NUREG-1437 is specific to the impacts as they relate to license renewal, most of the information can also be applied to this ESRP review. In addition sections 6.2.3 of NUREG-1437 discusses the sensitivity to recent changes in the fuel cycle on the environmental impacts. For the sake of consistency, the analysis of fuel-cycle impacts has been cast in terms of a model 1000-MWe light-water-cooled reactor (LWR) operating at an annual capacity factor of 80%. In the following review and evaluation of the environmental impacts of the fuel cycle, the staff conclusions would not be altered if the analysis were to be based on the net electrical power output of the proposed project.

Details on the staff's analysis and conclusions are found in NUREG-1437. A summary of the some of the specific impacts from the uranium fuel cycle and solid waste management issues that are relevant to this ESRP are described below as well as locations in NUREG-1437 on where to obtain additional details.

A. Land Use

A discussion of land-use impacts can be found in Section 6.2.2.6 of NUREG 1437. The total annual land requirement for the fuel cycle supporting a model 1000 MW(e) LWR is about 46 hectares (113 acres). Approximately 5 hectares (13 acres) are permanently committed land, and 41 hectares (100 acres) are temporarily committed. (A "temporary" land commitment is a commitment for the life of the specific fuel cycle plant, e.g., mill, enrichment plant, or succeeding plants. On abandonment or decommissioning, such land can be used for any purpose. "Permanent" commitments represent land that may not be released for use after plant shutdown and/or decommissioning.) Of the 41 hectares per year of temporarily committed land, 32 hectares (79 acres) are undisturbed and 9 hectares (22 acres) are disturbed. Considering common classes of land use in the United States, fuel cycle land-use requirements to support the model 1000 MW(e) LWR do not represent a significant impact. In comparison, a coal fired power plant of 1000 MW(e) capacity using strip mined coal requires the disturbance of about 81 hectares (200 acres) per year for fuel alone.

B. Water Use

A discussion of water-use impacts can be found in Section 6.2.2.7 of NUREG 1437. The principal water-use requirement for the fuel cycle supporting a model 1000 MW(e) LWR is that required to remove waste heat from the power stations supplying electrical energy to the enrichment step of this cycle. Of the total annual requirement of 43×10^6 m^3 (11.4×10^9 gal), about 42×10^6 m^3 are required

for this purpose, assuming that these plants use once through cooling. Other water uses involve the discharge to air (e.g., evaporation losses in process cooling) of about 0.6×10^6 m^3 per year and water discharged to ground (e.g., mine drainage) of about 0.5×10^6 m^3 per year.

On a thermal effluent basis, annual discharges from the nuclear fuel cycle are about 4% of the model 1000 MW(e) LWR using once through cooling. The consumptive water use of 0.6×10^6 m^3 per year is about 2% of the model 1000 MW(e) LWR using cooling towers. The maximum consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel cycle used cooling towers) would be about 6% of the model 1000 MWe LWR using cooling towers. Under this condition, thermal effluents would be negligible. The staff finds that these combinations of thermal loadings and water consumption are acceptable relative to the water use and thermal discharges of the proposed project.

C. Fossil Fuel Impacts

Electrical energy and process heat are required during various phases of the fuel cycle process. The electrical energy is usually produced by the combustion of fossil fuel at conventional power plants. Electrical energy associated with the fuel cycle represents about 5% of the annual electrical power production of the model 1000 MW(e) LWR. Process heat is primarily generated by the combustion of natural gas. This gas consumption, if used to generate electricity, would be less than 0.4% of the electrical output from the model plant. The staff finds that the direct and indirect consumption of electrical energy for fuel cycle operations is small and acceptable relative to the net power production of the proposed project.

D. Chemical Effluents

The quantities of chemical, gaseous, and particulate effluents with fuel cycle processes are given in Table S-3. The principal species are SO_x, NO_x, and particulates. Based on data in a Council on Environmental Quality Report (seventh annual report), these emissions constitute an extremely small additional atmospheric loading in comparison with these emissions from the stationary fuel combustion and transportation sectors in the United States, i.e., about 0.02% of the annual national releases for each of these species. The staff believes such small increases in releases of these pollutants are acceptable.

Liquid chemical effluents produced in fuel cycle processes are related to fuel enrichment, fabrication, and reprocessing operations and may be released to receiving waters. These effluents are usually present in dilute concentrations such that only small amounts of dilution water are required to reach levels of concentration that are within established standards. Table S-3 specifies the flow of dilution water required for specific constituents. Additionally, all liquid discharges into the navigable waters of the United States from plants associated with the fuel cycle operations will be subject to requirements and limitations set forth in an NPDES permit issued by an appropriate Federal, State, regional, local, or affected Native American tribal regulatory agency.

Tailings solutions and solids are generated during the milling process. These solutions and solids are not released in quantities sufficient to have a significant impact on the environment.

Additional details relating to the environmental impacts from chemical effluents can be found in Section 6.2.2.9 of NUREG-1437.

E. Radioactive Effluents

Radioactive effluents estimated to be released to the environment from reprocessing and waste management activities and certain other phases of the fuel cycle process are set forth in Table S-3. Using these data, the staff has calculated for 1 year of operation of the model 1000-MW(e) LWR, the 100-year involuntary environmental dose commitment to the U.S. population from the LWR-supporting fuel cycle. These calculations estimate that the overall involuntary total body gaseous dose commitment to the U.S. population from the fuel cycle (excluding reactor releases and the dose commitment due to radon-222) would be approximately 4 person-sievert (400 man-rem) per year of operation of the model 1000 MW(e) LWR (reference reactor year [RRY]). Based on Table S-3 values, the additional involuntary total body dose commitment to the U.S. population from radioactive liquid effluents due to all fuel cycle operations other than reactor operation would be approximately 2 person-sievert (200 man-rem) per year of operation. Thus, the estimated involuntary 100-year environmental dose commitment to the U.S. population from radioactive gaseous and liquid releases due to these portions of the fuel cycle is approximately 6 person-sievert (600 man-rem) (whole body) per RRY. Using risk estimators of 500 cancer deaths per 10,000 person-sievert (1 million man-rem) (NUREG/CR-4214, Rev. 2, Part I) (Evans et al. 1993), the estimated cancer risk would be 0.3 per RRY ($6 \times 500 \times 10^{-4}$).

At this time, Table S-3 does not address the radiological impacts associated with radon-222 releases and technetium-99 releases. NUREG-1437, Section 6.2.2.1, provides an analysis of the environmental impacts from these two radionuclides as they pertain to the uranium fuel cycle, including a detailed discussion of predicted health effects and the technical basis for the health effects.

F. Radioactive Wastes

The quantities of buried radioactive waste material (low level, high level, and transuranic wastes) are specified in Table S-3. For low level waste disposal at land burial facilities, the Commission notes in Table S-3 that there will be no significant radioactive releases to the environment. For high level and transuranic wastes, the Commission notes that these are to be buried at a Federal Repository and that no release to the environment is associated with such disposal, although it has been assumed that all of the gaseous and volatile radionuclides contained in the spent fuel are released to the atmosphere before the disposal of the waste. NUREG-0116, which provides background and context for the high level and transuranic Table S-3 values established by the Commission, indicates that these high level and transuranic wastes will be buried and will not be released to the biosphere. Section 6.2.2.2, Radioactive Wastes, describes the generation, storage, and ultimate disposal of low level waste, mixed waste and spent fuel from power reactors.

G. Occupational Dose

The annual occupational dose attributable to all phases of the fuel cycle for the model 1000 MWe LWR is about 6 person-sievert (600 man-rem). The staff concludes that this occupational dose will not have a significant environmental impact.

H. Transportation

The transportation dose to workers and the public totals about 0.25 person-sievert (25 man-rem)/RRY. This dose is small and is not considered significant in comparison to the natural background dose.

I. Fuel Cycle

The staff's analysis of the uranium fuel cycle did not depend on the selected fuel cycle (no recycle or uranium-only recycle), since the data provided in Table S-3 include maximum recycle option impact for each element of the fuel cycle. Thus, the staff's conclusions as to acceptability of the environmental impacts of the fuel cycle are not affected by the specific fuel cycle selected.

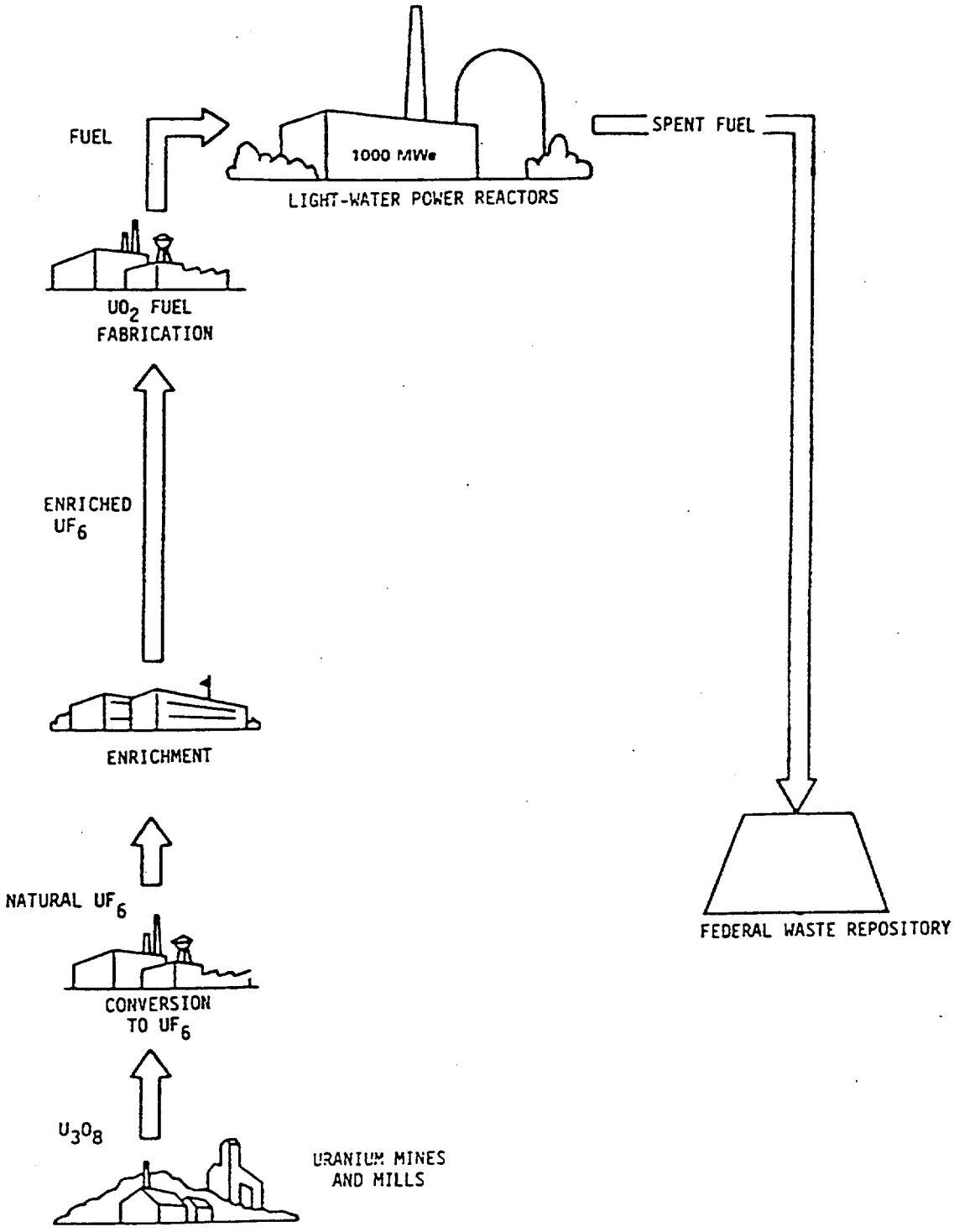

Figure 5.7-A-1. The Uranium Fuel Cycle: No-Recycle Option

Table 5.7-A-1. Summary of Environmental Considerations for Uranium Fuel Cycle[a]

(Normalized to Model LWR Annual Fuel Requirement
[WASH-1248] or Reference Reactor Year [NUREG-0116])

Environmental Considerations	Total	Maximum effect per annual fuel total requirement or reference reactor year of model 1000 MWe LWR
NATURAL RESOURCE USE		
Land (acres):		
Temporarily committed[b]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to 110 MWe coal-fired power plant
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to 95 MWe coal-fired power plant
Water (millions of gallons):		
Discharged to air	160	= 2% of model 1000 MWe LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	< 4% of model 1000 MWe LWR with once-through cooling
Fossil fuel:		
Electrical energy (thousands of MW-hour)	323	< 5% of model 1000 MWe LWR output
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45-MWe coal-fired power plant
Natural gas (millions of scf)	135	< 0.4% of model 1000 MWe energy output
EFFLUENTS - CHEMICAL (MT):		
Gases (including entrainment):[c]		
SO_x	4,400	
NO_x[d]	1,190	Equivalent to emissions from 45-MWe coal-fired plant for a year
Hydrocarbons	14	
CO	29.6	

Table 5.7-A-1. (contd)

Environmental Considerations	Total	Maximum effect per annual fuel total requirement or reference reactor year of model 1000 MWe LWR
Particulates	1,154	
Other gases:		
F	0.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of State standards—below level that has effects on human health
HCl	0.14	
Liquids:		
$^{=}SO_4$	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3—600 cfs., NO_3—20 cfs., Fluoride—70 cfs.
$^{-}NO_3$	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^{-}	8.5	
Na^{+}	12.1	
NH_3	10.0	
Fe	0.4	
Tailings solutions (thousands of MT)	240	From mills only—no significant effluents to environment
Solids	91,000	Principally from mills—no significant effluents to environment
EFFLUENTS—RADIOLOGICAL (CURIES):		
Gases (including entrainment):		Presently under reconsideration by the Commission
Rn-222		
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	Principally from fuel-reprocessing plants
Ru-106	0.14	
I-129	1.3	
I-131	0.83	Presently under consideration by the Commission
Tc-99		

Table 5.7-A-1. (contd)

Environmental Considerations	Total	Maximum effect per annual fuel total requirement or reference reactor year of model 1000 MWe LWR
Fission products and transuranics	0.203	
Liquids:		
Uranium and daughters	2.1	Principally from milling-included in tailings liquor and returned to ground-no effluents; therefore, no effect on environment
Ra-226	0.0034	From UF_6 production
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants - concentration 10% of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR
Fission and activation products	5.9×10^{-6}	
Solids (buried onsite):		
Other than high level (shallow)	11,300	9100 Ci comes from low-level reactor wastes, and 1500 Ci comes from reactor decontamination and decommissioning—buried at land burial facilities. 600 Ci comes from mills—included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent-fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^{7}	Buried at Federal Repository
Effluents—thermal (billions of British thermal units)	4063	< 5% of model 1,000 MWe LWR
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management

Table 5.7-A-1. (contd)

Environmental Considerations	Total	Maximum effect per annual fuel total requirement or reference reactor year of model 1000 MWe LWR

Notes:

(a) In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the Table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the Table. Table S-3 does not include health effects from the effluents described in the Table, or estimates of releases of radon-222 from the uranium fuel cycle or estimates of technetium-99 released from waste-management or reprocessing activities. These issues may be the subject of litigation in the individual licensing procedures.
Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248, April 1974; the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp. 1 to WASH-1248); the " Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (Supp. 2 to WASH-1248); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM-50-3 (NRC 1996). The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

(b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years since the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

(c) Estimated effluents based upon combustion of equivalent coal for power generation.

(d) 1.2% from natural gas use and process.

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5.8 SOCIOECONOMIC IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the socioeconomic impacts of station operation. The scope of the paragraph covered by this plan is to introduce the material from the reviews conducted under ESRPs 5.8.1 through 5.8.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's potential socioeconomic impacts is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 5.8.1 through 5.8.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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5.8.1 PHYSICAL IMPACTS OF STATION OPERATION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and assessment of the direct physical impacts of plant operation on the community. Among these are the affects of noise, odors, exhausts, thermal emissions, and visual intrusion.

The scope of the review directed by this plan should be of sufficient detail to permit the reviewer to predict and assess potential impacts and to evaluate how these impacts should be treated in the licensing process. Where necessary, the reviewer should consider alternative locations, designs, and procedures that would mitigate predicted adverse impacts.

Review Interfaces

The reviewer for this ESRP should receive input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRPs 2.1 and 2.2.1. Provide a detailed description of the plant location and the surrounding region affected by the plant operations.
- ESRP 2.3.2. Obtain descriptions of bodies of water whose use is likely to be affected by noise, odor, dust, or other direct socioeconomic impacts during plant operations or which could be affected aesthetically by plant operations.

- ESRP 2.5. Obtain the socioeconomic features such as population and community characteristics of the site environs that potentially may be subject to physical impacts from plant operations.

- ESRP 2.7. Obtain estimates of the impacts of non-radiological emissions related to plant construction on air quality.

- ESRP Chapter 3.0. Use the description of the proposed plant operations to determine what physical impacts on the surrounding region may result.

- ESRP 4.1.1. Obtain the potential environmental impacts from plant operations on local land use that may have associated physical impacts.

- ESRP 4.4.1. Obtain the physical impacts that were associated with plant construction to determine whether they might also apply for plant operations.

- ESRP 5.3.3.1. Obtain descriptions of impacts on plumes, solids deposition, cloud formation, ground-level humidity, etc. as a result of operation of the heat discharge system that could affect recreational activity or aesthetics.

- ESRP 5.5. Obtain impacts associated with operations of the plant nonradioactive waste system that might also cause other physical impacts.

- ESRP 5.5.3. Determine whether impacts associated with plant cooling system operations might also cause other physical impacts during plant operations.

- ESRP 5.10. Provide a list of applicant commitments and staff evaluations of measures and controls to limit adverse impacts of operation.

- ESRPs 9.3 and 9.4. If the reviewer concludes that there are physical impacts of operation that are adverse and should be avoided, then provide a request to the reviewers for ESRPs 9.3 and 9.4 to consider alternative plant designs, locations, or operating procedures that would avoid the impacts.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- plant layout (from ESRP 3.1)

- distribution of people, buildings, roads, and recreational facilities that are vulnerable to impact by plant operation (from the environmental report [ER and local planning officials.])

- predicted noise levels and nonradiological air pollutant levels at sensitive areas as identified above (from the ER)

- plant visual appearance from sensitive surrounding areas (from ESRP 3.1). Consider visual aesthetic and visibility effects of visual plumes.

- applicable standards for levels of noise and gaseous pollutants (from consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- applicant's proposed methods to reduce visual impacts and impacts of noise and other pollutants (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for noise, dust, air pollution, and visual aesthetics are based on meeting the relevant requirements of the following:

- 10 CFR 51.71 and 10 CFR 51.45 as related to the potential significance of physical impacts of station operations.

- 29 CFR 1910, "Occupational and Health Standards," with respect to noise, dust, and air pollution

- 40 CFR 50-90 as related to National Primary and Secondary Air Quality Standards

- Clean Air Act of 1970, as amended, as related to air quality during plant operations

- Occupational Safety and Health Act, Noise Provision, 39 *Federal Register* 10518, Department of Labor, OSHA (May 29, 1971) with respect to noise pollution standards

Regulatory guidance and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to economic and social impact of plant operations.

Technical Rationale

The technical rationale for evaluating the applicant's potential physical impacts of station operation is discussed in the following paragraphs:

In accordance with 10 CFR 51.45(d), the applicant is required to submit in the ER information needed for evaluating these factors. Similar information is required to be present in the EIS pursuant to 10 CFR 51.71.

Reasonably detailed information about the physical socioeconomic impacts of the site in question is required to assess any potential of social or economic impacts that might occur as a result of plant operation. Data in the ER must be adequate to make these determinations.

III. REVIEW PROCEDURES

The reviewer's analysis of operational impacts on the community will be linked to the environmental reviews directed by ESRPs 2.1, 2.2.1, 2.5.1, and 2.5.2; all of ESRP Chapter 3.0; and ESRPs 5.3.3, 5.5.1, and 5.5.2 to ensure that the environmental factors most likely to be impacted by proposed plant operation are adequately addressed. To evaluate the information presented in the applicant's environmental report, the reviewer should take the following steps:

(1) Identify the people, buildings, roads, and recreational facilities that could be affected for each potential impact.

- Determine the
  - sensitive use patterns (e.g., hospitals, residences, recreational areas, viewsheds)
  - allowable limits of impacts, where available.
- Consider impacts from noise, air pollution, and visual intrusion.

(2) Identify the potential operational impacts on these elements and predict the extent and magnitude of the impacts. Impacts may be described in qualitative terms if the effect on the community is expected to be small.

(3) If adverse impacts can be predicted, conduct a more detailed analysis and, where practical, make quantitative estimates of the magnitude of the impacts.

(4) Consult with the reviewer for ESRP 4.1.1 to identify the construction features that are expected to have operational impacts (e.g., access roads). If operational impacts are projected to be temporary extensions of the construction impact, this may be noted, and no further analysis will be needed.

(5) Consult with the reviewers of both ESRPs 3.7 and 4.4.1 to complete the analysis of visual impacts, with emphasis on the identification of measures and controls (e.g., screening) to mitigate the impacts determined to be adverse.

(6) Identify those proposed design features and operating procedures that can be expected to mitigate the physical impacts. Means available for mitigation include

- drift and noise eliminators
- air pollution control devices
- landscaping for visual screening.

(7) Become familiar with the provisions of standards, guides, and agreements pertinent to the operational impacts of nuclear power stations.

(8) Consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies to verify that current applicable regulations and guides are available. For example, consult

- the EPA for ambient air quality standards and air pollutant levels
- the Occupational Safety and Health Administration guidelines and standards applicable to facility operation.

(9) Verify that the applicant has made commitments to comply with these applicable regulations and guides.

(10) Examine proposed operation activities in light of recognized "good practice." The term "good practice" as used here refers to those activities that tend to mitigate noise levels and adverse physical impacts on the community.

IV. EVALUATION FINDINGS

Input to the EIS should accomplish the following objectives: (1) public disclosure of physical impacts resulting from plant operation, (2) presentation of the basis for the staff analysis, and (3) presentation of staff conclusions regarding physical impacts of station operation to the community.

If the site is remote from communities and does not represent a visual intrusion, and it is found that the applicant can operate in compliance with appropriate guides and standards, then these facts should be stated with only a very brief discussion noting that under these conditions physical socioeconomic impacts should be minor. If the foregoing conditions are not met, or if there are no applicable standards, then predicted impacts should be described along with conclusions regarding the significance of the effect on the community.

Evaluation of each identified impact should result in one of the following determinations:

- *The impact is minor, and mitigation is not required.* When all impacts are of this nature, the reviewer should include a statement of the following type:

  > The staff reviewed the available information on the operations of the proposed facility. Based on this review, the staff concludes that there are no significant physical socioeconomic impacts as a result of plant operations.

- *The impact is adverse, but can be mitigated by design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the Environmental Project Manager and the reviewers for ESRP 9.4 to verify that the reviewer's

proposed modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications and identified measures and controls to limit the corresponding impact. These lists should be provided to the reviewer for ESRP 5.10.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the reviewers for ESRPs 9.3 and 9.4 that an analysis and evaluation of alternative sites, designs, or procedures is needed. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer should be responsible for providing this information to the reviewer for ESRP 10.1.

If the reviewer determines that no situations exist that suggest an adverse impact, then no evaluation will be required. If unusual situations, such as excessive fogging, icing, or drift, exist, the reviewer should identify mitigating actions.

The reviewer should verify that sufficient information has been provided in accordance with the requirements of this ESRP and that the evaluation supports the following type of concluding statement to be included in the staff's EIS:

> The staff reviewed the available information relative to the community's social and economic characteristics. The staff concludes that the information is adequate to satisfy the requirements of 10 CFR 51.45 and the intent of 10 CFR 51.71.

These conclusions are based on the following:

- The applicant has developed the information using the recommended information sources and approaches suggested by prevailing professional practice.

- The information sources used are the most recently updated versions.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

29 CFR 1910, "Occupational and Health Standards."

40 CFR 50-90, "National Primary and Secondary Air Quality Standards."

Clean Air Act Amendments of 1977, as amended, 41 USC 7401 et seq.

U.S. Department of Labor. "Occupational Safety and Health Act, Noise Provision," 39 *Federal Register* 10518 (May 29, 1971).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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5.8.2 SOCIAL AND ECONOMIC IMPACTS OF STATION OPERATION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and evaluation of the social and economic impacts of plant operation on the surrounding region[a] and individual communities that could be affected. The reviewer should identify specific impacts, where they could occur, and predict their relative magnitude.

The scope of the review directed by this plan includes the social and economic impacts that result from operation of the plant and from requirements of the operating staff. Categories of impacts resulting from operation of the station include (1) regional labor, (2) tax revenues to local jurisdictions, (3) public facilities and services, (4) social or economic consequences of water-use or land-use impacts, and (5) local planning/political decisionmaking processes. Categories of impacts flowing from the requirements of the operating staff include (1) settlement pattern and housing, (2) education, (3) other public facilities and service, (4) private sector goods and services, (5) local employment and income, (6) tax revenues to local jurisdictions, (7) local planning political decision processes, and (8) social structure and community cohesion. For most situations, e.g., refueling outage activities, most impacts will generally be minor when compared with the corresponding impacts during plant construction. The review should be of sufficient detail to permit the reviewer to predict and assess potential impacts and to consider how these impacts should be treated in the licensing process (i.e., consideration of alternative locations, designs, practices, or procedures that would mitigate predicted adverse impacts).

(a) See ESRP 2.5.2 for a definition of "region."

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 2.1 and 2.2.1. Obtain a detailed description of the plant location and of the surrounding region affected by the plant operations.
- ESRPs 2.5.1 and 2.5.2. Obtain the socioeconomic features such as population and community characteristics of the site environs that may be subject to economic impacts from plant operations.
- ESRP 4.4.2. Obtain the economic impacts that were associated with plant construction to determine whether they might apply for plant operations.
- ESRP 5.1.1. Obtain the land-use impacts associated with plant operations that might also cause economic impacts in the region.
- ESRP 5.2.2. Obtain the economic impacts that might be caused by the operation of the plant's water supply system.
- ESRP 5.10. Provide a list of applicant commitments and staff evaluation of measures and controls to limit adverse impacts of operation.
- ESRPs 9.3 and 9.4. If the reviewer concludes that there are social and economic impacts of operation that are adverse and should be avoided, then obtain input from the reviewers of ESRPs 9.3 and 9.4 to consider alternative plant designs, locations, or operating procedures that would avoid the impacts.
- ESRP 10.1. Provide a list of any unavoidable impacts that are predicted to occur as a result of the proposed plant operation.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. Most of this information has been developed under ESRP 2.5.2 and has been further processed in the analysis covered by ESRP 4.4.2. The analysis of the impacts resulting from station operation requires knowledge of these data and information. The following data or information should be obtained:

- political structure (from ESRP 2.5.2)
- demography/settlement pattern (from ESRP 2.5.1)
- social structure (from ESRP 2.5.2)
- housing: estimated operating staff housing requirements (from the environmental report [ER])

- education (from ESRP 2.5.2)
- recreation (from ESRP 2.5.2)
- taxation (from ESRP 2.5.2)
- land-use planning and zoning (from ESRP 2.5.2)
- social services and public facilities (from ESRP 2.5.2)
- highways and transportation (from ESRP 2.5.2)
- operationally induced factors:

  - expenditures within the region for materials and services during operation (from the ER)
  - plans to adjust public facilities and services during the transition period from the construction to the operation phase and agencies responsible for accomplishing this adjustment (from the ER and consultations with state and local agencies)
  - taxes by type and jurisdiction to be paid annually during operation (from the ER and consultations with state and local agencies)
  - annual operation labor force (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria are for including socioeconomic impacts during operations based on meeting the relevant requirements of the following:

- 10 CFR 51.45(c) with respect to analysis of socioeconomic data

- 10 CFR 51.45(d) and 51.71(d) with respect to the socioeconomic impacts of plant operations analyses required in the development of the ER and EIS

- 10 CFR 52.18 with respect to reviewing applications for early site permits

- 10 CFR 52.81 with respect to reviewing applications for combined licenses.

Regulatory positions and specific criteria to meet the regulations identified are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976) with respect to benefits and costs to nearby populations during operations.

Technical Rationale

The technical rationale for evaluating the applicant's socioeconomic impacts during operations is discussed in the following paragraph:

In accordance with 10 CFR 51.45(d), the applicant is required to submit in the ER socioeconomic impact information needed for evaluating these factors. Similar information is required to be present

in the EIS pursuant to 10 CFR 51.71. Any significant economic and community impacts on the site environs potentially resulting from plant operation should be documented.

III. REVIEW PROCEDURES

The reviewer's analysis of the social and economic impacts of operation should be linked to the environmental descriptions provided by the reviewer for ESRP 2.5.2 and the construction impact assessments of ESRP 4.4.2. The reviewer should ensure that those environmental factors most likely to be impacted by operation of the proposed plant are described in sufficient detail to permit assessment of the predicted impacts. To evaluate this information, the reviewer should take the following steps:

(1) Identify and analyze components of the regional and community social, political, and economic systems that would be potentially impacted.

(2) Determine, from the full scope of potential impacts, those that are minor and those that are likely to be sufficiently important to require detailed analysis.

- Generally, operating impacts other than those related to tax revenues will be less than the corresponding impacts of construction.

- It may not be necessary to re-address impacts determined to be minor by the reviewer for ESRP 4.4.2.

(3) Where practical, develop quantitative measures of identified adverse impacts.

(4) Consult with the reviewers for ESRPs 5.1.1 and 5.2.2 to determine if any of the impacts identified under these sections are projected to be of sufficient social or economic consequence to be examined further under this plan.

(5) Categorize impacts into those resulting directly from plant operation and those resulting from the requirements of the operating staff using the following procedure:

- Analyze the social and economic impacts directly associated with plant operation, as follows:

  - Determine by jurisdiction the tax revenues derived from station operation.

  - Predict the physical demands placed on local public facilities and services (e.g., fire, police, sewer and water) by plant operation and compare these demands with existing facilities and services.

  - In consultation with appropriate reviewers, determine if any impacts identified under land-use or water-use impacts require further analysis regarding social and economic consequences.

- Analyze the socioeconomic impacts associated with the operating staff, as follows:

  - Determine the operating staff requirements by predicting the number of workers originating from within the region and the number of in-migrants.

  - Predict the geographic distribution of in-migrants.

  - Estimate the overall impact of in-migrants and procurements of goods and services on regional income, employment, and population.

  - Estimate the flow of tax revenues generated by the operational payroll and induced economic activity.

- Describe any unique changes predicted to occur in the social and political structure and character of impacted communities, labor force mobility, and residential choices and describe the mechanisms available to these communities to plan for and accommodate change induced by plant operation. Include the socioeconomic effects in any analysis of potential plant accident scenarios.

- Consider the following types of socioeconomic impacts: labor force mobility and residential choices; impacts linked to changes in visual quality; and impacts from changes in tourism and recreation.

IV. EVALUATION FINDINGS

Input to the EIS should accomplish the following objectives: (1) public disclosure of social and economic impacts resulting from plant operation, (2) presentation of the basis for the staff analysis, and (3) presentation of staff conclusions regarding impacts of plant operation on the region's social, political, and economic structure. The following data or information should be included in the EIS:

- a statement of the scope of coverage and the objectives of the analysis

- a summary of the steps taken in the analysis and reference to methodologies employed

- a summary of the findings of the analysis (the level of detail provided should be related to the severity of the anticipated impact)

- identification and assessment of potential mitigation measures.

Evaluation of each identified impact should result in one of the following determinations:

- *The impact is minor, and mitigation is not required.* When all impacts are of this nature, the reviewer should include a statement of the following type:

The staff reviewed the available information on the operations of the proposed facility. Based on this review, the staff concludes that there are no significant socioeconomic impacts on communities in the vicinity of the plant as a result of plant operations.

- *The impact is adverse, but can be mitigated by design or procedure modifications that the reviewer has identified and determined to be practical.* For these cases, the reviewer should consult with the Environmental Project Manager and the reviewers for ESRP 9.4 for verification that the reviewer's proposed modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications and identified measures and controls to limit the corresponding impact. These lists should be given to the reviewer for ESRP 5.10.

- *The impact is adverse, cannot be successfully mitigated, and is of such magnitude that it should be avoided.* When impacts of this nature are identified, the reviewer should inform the reviewers for ESRP 9.4 that an analysis and evaluation of alternative designs or procedures is needed. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no such alternatives can be identified, the reviewer is responsible for providing this information to the reviewer for ESRP 10.1.

The reviewer should categorize impacts as those over which the applicant has some control and those over which the applicant has little or no control. If the applicant has control over impacts, the criteria outlined above should be applied.

If the applicant has little or no control over alternatives to mitigate impacts that in the reviewer's judgment are adverse, then the reviewer should (1) prepare a description of these impacts for inclusion in the EIS, (2) where appropriate, identify potential solutions to the problem that are beyond the jurisdiction of the NRC, and (3) ensure that these impacts are considered in the staff's final evaluation of the proposed action.

The reviewer verifies that sufficient information has been provided in accordance with the requirements of this ESRP and that the evaluation supports the following type of concluding statement, to be included in the staff's EIS:

The staff reviewed the available information relative to the socioeconomic impacts of plant operation and maintenance. The staff concludes that the information is adequate to satisfy the requirements of 10 CFR 51.45. These conclusions are based on the following:

- The applicant has developed the information using the recommended information sources and approaches suggested by prevailing professional practice.

- The information sources used are recently updated versions.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 52.18, "Standards for review of applications."

10 CFR 52.81, "Standards for review of applications."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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5.8.3 ENVIRONMENTAL JUSTICE IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review of environmental impacts on minority and low-income populations from proposed project routine operations and reasonably anticipated accidents to the extent that such information can serve as the basis of an environmental impact statement (EIS) section on environmental justice.

The scope of the review directed by this plan should include consideration of the methods that are used to identify and quantify impacts on minority and low-income populations, the location and significance of any environmental impacts during operations on populations that are particularly sensitive, and any additional information pertaining to mitigation. The descriptions to be provided by this review should be of sufficient detail to permit subsequent staff assessment and evaluation of specific impacts, in particular whether these impacts are likely to be negative and disproportionate.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.5.4. Obtain descriptions of the minority and low-income populations that could be disproportionately impacted by proposed project operations and the mechanisms (including socioeconomic) by which disproportionate harm could occur.

- ESRP 3.1. Obtain descriptions of power systems.

- ESRP 3.7. Obtain descriptions of power transmission systems and operations.

- ESRPs 5.1 through 5.8. Obtain descriptions of potential environmental (including socioeconomic [CEQ 1997]) impacts.

- ESRP 7.1. Obtain descriptions of potential accidents.

- ESRPs 9.3 and 9.4. If the reviewer concludes that proposed operations will result in disproportionate adverse impacts on minority or low-income populations that should be avoided, then obtain input from the reviewers for ESRPs 9.3 and 9.4 to consider alternate plant designs, locations, or activities during operations that would avoid the impacts.

- ESRP 10.1. Provide descriptions of unavoidable adverse environmental impacts that disproportionately affect minority and low-income populations during operations.

- ESRP 10.2. Provide descriptions of environmental impacts that disproportionately affect minority and low-income populations during operations through short-term use and long-term productivity.

- ESRP 10.3. Provide descriptions of irreversible and irretrievable environmental impacts that disproportionately affect minority and low-income populations as a result of operations.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The data requirements analysis should generally be the same for any type of environmental review that requires the preparation of an environmental report (ER). The following data or information should be obtained:

- pathways where any environmental impact during routine operations and reasonably anticipated accidents may interact with cultural or economic facts that may result in disproportionate environmental impacts on minority and low-income populations

- any assessment (qualitative or quantitative, as appropriate) of the degree to which each minority or low-income population is disproportionately receiving adverse human health or environmental (including socioeconomic) impacts during routine operations and reasonably anticipated accidents as compared with the entire geographic area. In addition, information should be obtained on any assessment comparing the impacts with the larger overall geographic area encompassing all of the alternative sites.

- any assessment (qualitative or quantitative, as appropriate) of the significance or potential significance of such environmental impacts on each minority and low-income population

- any assessment of the degree to which each minority and low-income population is disproportionately receiving any benefits compared with the entire geographic area

- any discussion of any mitigative measures for which credit is being taken to reduce environmental justice concerns

- when alternative sites are being evaluated, the same reviews should be available for each site.

Supplemental data provided by other individuals and organizations may be useful in determining the completeness of the applicant's identification of minority and low-income populations.

II. ACCEPTANCE CRITERIA

The acceptance criteria for environmental justice impacts are based on the relative requirement of the following:

- 10 CFR 51.45 (c) with respect to analysis of socioeconomic data

- Executive Order 12898 (59 FR 7629) with respect to Federal actions to address environmental justice in minority and low-income populations.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- the Council on Environmental Quality guidance for addressing environmental justice, "Environmental Justice: Guidance Under the National Environmental Policy Act," Draft CEQ Guidance December 10, 1997 (CEQ 1997).

- the guidelines for specific information requirements for environmental justice determinations are described in Attachment 4 to Office of Nuclear Reactor Regulation (NRR) Office Letter No. 906, Revision 1: "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" (NRC 1996). NRR Office Letter No. 906 is revised periodically. Obtain the latest revision for current guidance. Information submitted by the applicant is adequate and meets the 10 CFR 51.45 requirements and NRR guidelines if it permits the identification of minority and low-income populations as required in that guidance.

Technical Rationale

The technical rationale for evaluating the applicant's potential environmental justice impacts is discussed in the following paragraphs:

10 CFR 51.45 requires applicants to provide the information that the commission needs in its development of independent analysis. The memorandum accompanying Executive Order 12898 directs Federal agencies to consider environmental justice as part of the NEPA process. Although NRC is an independent agency, it has agreed to comply with the Executive Order.

The purpose of the environmental justice assessment is to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects on minority and low-income populations. These populations may be present in scattered small groups or may have unusual customs, practices, or dependencies on specific resources that would be overlooked in a broader analysis that focuses on the majority population. As a result, it is necessary to evaluate impacts for each such population and more carefully examine unusual environmental pathways (including socioeconomic pathways) that could result in disproportionately high impacts on them.

III. REVIEW PROCEDURES

The kinds of data and information required will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impact. The data-requirements analysis should generally be the same for any type of environmental review that requires the preparation of an environmental report (ER).

(1) Determine which impacts are likely to be of concern and, therefore, what environmental impact areas should be discussed.

- Contact the lead staff responsible for ESRPs 5.1 through 5.8 to determine whether the appropriate impact areas are being discussed
- Contact the lead staff responsible for ESRP 7.1 to obtain a description of potential accidents.
- Examine the record of the public scoping process to determine whether appropriate environmental impact areas are being discussed with respect to environmental justice.
- Contact the responsible personnel of each affected State for sites located on or near State boundaries, or where transmission line routes, access corridors, or offsite areas pass through more than one State.

Supplemental data obtained from other individuals and organizations may be useful in determining the completeness of the applicant's identification of minority and low-income populations.

(2) Analyze the potential impacts on minority and low-income populations.

- briefly describe pathways by which any environmental impact during operations may interact with cultural or economic facts that may result in disproportionate environmental impacts on minority and low-income populations.

- assess (qualitative or quantitative, as appropriate) the degree to which each minority or low-income population would disproportionately experience adverse human health or environmental impacts during operations as compared to the entire geographic area

- assess the degree to which each minority and low-income population would disproportionately receive any benefits compared to the entire geographic area

- assess (qualitative or quantitative, as appropriate) the significance or potential significance of such environmental impacts on each minority and low-income population. Significance is determined by considering the disproportionate exposure, multiple-hazard conditions, and cumulative hazard conditions outlined in the Environmental Justice: Guidance Under the National Environmental Policy Act (CEQ 1997).

- discuss any mitigative measures for which credit is being taken to reduce environmental justice concerns.

IV. EVALUATION FINDINGS

The depth and extent of the information in the environmental statement will be governed by the extent and significance of the identified minority and low-income populations and by the nature and magnitude of the expected impacts of operation.

Data provided by the applicant should be considered adequate if

- the data in the ER adequately describe the degree to which each minority or low-income population would disproportionately experience adverse human health or environmental impacts during operations as compared to the entire geographic area, and these data are in agreement with data obtained from other sources, when available. In addition, a similar assessment is made in the ER for each of the sites in comparison to the larger geographic region that encompasses all of the sites.

- when applicable, data in the ER adequately describe the significance or potential significance of such environmental impacts on each minority and low-income population

- when applicable, data in the ER adequately describe the degree to which each minority or low-income population would disproportionately receive any benefits during operations in comparison to the entire geographic area

- when applicable, data in the ER adequately describe any mitigative measures for which credit is being taken to reduce environmental justice concerns

- the data in the ER adequately consider the unique lifestyles and practices of minority and low-income communities (for example, subsistence activities or dependence on specific water supplies) that could result in disproportionate impacts from plant operations and site operations.[a]

The following information should be included in the EIS:

- a statement (qualitative or quantitative, as appropriate) about the degree to which each minority or low-income population would disproportionately experience adverse human health or environmental impacts during operations as compared to the entire geographic area, together with the significance of these impacts

- a discussion of the reasoning (e.g., based on locations of minority and low-income populations and the environmental pathways described in ESRP 2.5.4) behind the estimated degree of impact

- a discussion of any mitigative measures for which credit is being taken to reduce environmental justice concerns.

The reviewer should verify that sufficient information is available to meet the relevant requirements and that the evaluation supports statements of the following type to be included in the Commission's EIS:

> Based on review of the information provided by the applicant, the staff find that no minority or low-income group will experience disproportionately high and adverse environmental impacts as a result of activities during operations.

If the reviewer determines that there would be a disproportionately high and adverse environmental impact on some minority or low-income population as a result of activities during operations, then a statement for the EIS should be prepared that describes the impact(s) and the staff evaluation of alternatives that would mitigate or avoid the impact.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

(a) An example of unusual practices can be found in *In the Matter of Louisiana Energy Service Clairborne Enrichment Center* (NRC 1998), where proposed relocation of a road between two settlements disproportionately and adversely affected minority and low-income individuals who ordinarily walked between the two settlements.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Draft CEQ Guidance, December 10, 1997, Washington, D.C.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." 59 *Federal Register* 7629-7633 (1994).

U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation (NRC/NRR). 1996. "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues." NRR Office Letter No. 906, Revision 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *In the Matter of Louisiana Energy Services Claiborne Enrichment Center*. Docket 70-370-ML. CLI-98-3. U.S. Nuclear Regulatory Commission, Washington, D. C. April 3, 1998.

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5.9 DECOMMISSIONING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and evaluation of decommissioning and provides for staff input to the environmental impact statement (EIS) (as given in Appendix A to this ESRP).

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 9.2.3. The reviewer should provide the reviewer for ESRP 9.2.3 with any cost estimates for radiological decommissioning that have been provided by the applicant. If the applicant has not estimated the decommissioning cost, the reviewer should provide the minimum numbers specified in 10 CFR 50.75(c).

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- A report as specified in 10 CFR 50.75(b)(I) and required by 10 CFR 50.33(k) containing a certification that financial assurance for radiological decommissioning will be provided (from the application).

I. ACCEPTANCE CRITERIA

Acceptance criteria for the analysis and evaluation of decommissioning are based on the relevant requirements of the following:

- 10 CFR 50.33 with respect to preparing a decommissioning funding plan report on how funds will be available to radiologically decommission the facility

- 10 CFR 50.75 with respect to the requirements for reasonable assurance that funds will be available to radiologically decommission the facility, and with respect to the minimum amounts required to demonstrate such assurance

- 10 CFR 52.77 with respect to requirements for a combined license, including the information specified in 10 CFR 50.33 to provide a decommissioning funding plan report showing how reasonable assurance will be given that funds will be available to radiologically decommission the facility.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- *Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance* (NRC 1999), which provides review procedures for verifying the information submitted by a new applicant for an operating license in the form of a report indicating how reasonable assurance will be given that funds will be available to radiologically decommission the facility.

Technical Rationale

The technical rationale for evaluation of the applicant's potential impacts from the decommissioning process is discussed in the following paragraph:

An applicant for a license to operate a nuclear power facility is required by 10 CFR 50.33(k) to provide a report containing a certification that financial assurance for radiological decommissioning will be provided. The amount may be based on a cost estimate for decommissioning the facility that may be more, but not less, than that given in the table in 10 CFR 50.75(c)(1). The purpose of this requirement, which is described as 10 CFR 50.75, is to ensure that a licensee will be financially able to radiologically decommission a facility when it ceases to produce power. This requirement does not apply to applications for a construction permit or an early site permit. It does apply to applications for a combined license (10 CFR 52.77). Further information relating to the decommissioning

process (such as a description of the decommissioning process and schedule) is not required until after permanent cessation of operation and is not expected during the initial licensing or license-renewal phases.

III. REVIEW PROCEDURES

NRC regulations do not require the applicant to submit detailed plans for decommissioning plans and, in the absence of such plans, no detailed analysis of decommissioning is necessary. However, applicants for operating licenses (10 CFR 50.33[k]) and combined licenses (10 CFR 52.77) must include as part of their application a report that contains a certification that financial assurance for decommissioning will be provided in an amount that may be more, but not less, than the amount stated in the table in 10 CFR 50.75(c)(1).

The reviewer should take the following steps:

(1) The reviewer should ensure that the applicant has submitted the report required by 10 CFR 50.33(k) and specified in 10 CFR 50.75(b)(1).

(2) The reviewer should coordinate with the reviewer of the Decommissioning Funding Assurance in the Generic Issues and Environmental Projects Branch to ensure that the appropriate review is being or has been made and to obtain the cost estimate for decommissioning the proposed facility (if available) or the amount from the table in 10 CFR 50.75(c)(1) as well as the means for financial assurance.

IV. EVALUATION FINDINGS

Appendix A to this plan provides input on decommissioning to the EIS that should be used by the reviewer. This input should be used for reviews of operating licenses and combined license reviews.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR 50.33, "Contents of application; general information."

10 CFR 50.51, "Continuation of license."

10 CFR 50.75, "Reporting and recordkeeping for decommissioning planning."

10 CFR 50.82, "Termination of license."

10 CFR 52.77, "Contents of applications; general information."

U.S. Nuclear Regulatory Commission (NRC). 1996a. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 *Federal Register* 28467 (June 5, 1996). Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1996b. *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*. NUREG-0586, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance*. NUREG-SR1577, Revision 1, Washington, D.C.

APPENDIX A

INPUT TO THE ENVIRONMENTAL STATEMENT

A license to operate a nuclear-power plant is issued for a term not to exceed 40 years, from the date of issuance (10 CFR 50.51). At the end of the specified period, the operator of a nuclear power plant must renew the license for another time period (*Environmental Review for Renewal of Nuclear Power Plant Operating Licenses*, 61 FR 28467, [NRC 1996ca]) or must decommission the facility. Preceding the expiration of the operating license, if technical, economic, or other factors are unfavorable to continued operation of the plant, the operator may elect to prematurely initiate the decommissioning process (10 CFR 50.82). Decommissioning is defined as "permanently removing a nuclear facility from service and reducing radioactive materials on the licensed site to levels that would permit termination of the Nuclear Regulatory Commission (NRC) license."

The *Final Generic Environmental Impact Statement (GEIS) on Decommissioning of Nuclear Facilities*, NUREG-0586 (NRC 1996bb), evaluates the environmental impact of the following three decommissioning methods.

DECON—The equipment, structures, and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that permits termination of the license shortly after cessation of operations.

SAFSTOR—The facility is placed in a safe stable condition and maintained in that state until it is subsequently decontaminated and dismantled to levels that permit license termination. During SAFSTOR, a facility is left intact, but the fuel has been removed from the reactor vessel, and radioactive liquids have been drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thus reducing the quantity of contaminated and radioactive material that must be disposed of during decontamination and dismantlement.

ENTOMB—This alternative involves encasing radioactive structures, systems, and components in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license.

The following input should be included for operating license and combined license reviews:

Regulations in 10 CFR 50.75 and 10 CFR 50.82 presented technical and financial criteria for decommissioning licensed nuclear facilities. These regulations address decommissioning, planning needs, timing, funding methods, and environmental review requirements.

At the time of applying for a license to operate a nuclear power plant, the applicant must show possession or "reasonable assurance of obtaining the funds necessary to cover the estimated costs of permanently shutting the facility down and maintaining it in a safe condition" (10 CFR 50.33).

Applicants for operating licenses of commercial nuclear power reactors are required to submit a report as specified in 10 CFR 50.75(b)(i1) and required by 10 CFR 50.33(uk)(1) contains a certification that financial assurance for radiological decommissioning will be provided. This information must be submitted with or before the application for an operating license. The amount stated in the certification may be based on a cost estimate for decommissioning the facility. Tables of minimum amounts required to demonstrate reasonable assurance of funds are given in 10 CFR 50.75(c)(i1). These minimum amounts are based on reactor type (pressurized-water reactor vs. boiling-water reactor) and on the power level. Adjustment factors are also provided (10 CFR 50.75(c)(2)) based on escalation factors for labor, energy, and waste burial costs.

Financial assurance as described in 10 CFR 50.75 is to be provided by prepayment, an external sinking fund (into which deposits are made periodically), or surety, insurance, or some other guarantee method. Prepayment may be in the form of deposits of cash or liquid assets, sufficient to pay decommissioning cost, into an account segregated from licensee's assets and outside the licensee's administrative control. It may also be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities or other payment acceptable to the NRC. An external sinking fund is established and maintained by setting funds aside periodically in an account segregated from licensee assets and outside the licensee administrative control, in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund may also be in the form of a trust, escrow account, government fund, certificate of deposit, deposit of government securities, or other payment acceptable to the NRC. The surety or insurance method would guarantee that decommissioning costs will be paid should the licensee default. A surety method may be in the form or a surety bond, letter of credit, or line of credit. Any surety or insurance method used to provide financial assurance for decommissioning must meet specific conditions; for example, it must be payable to a trust established for decommissioning costs. Federal Government licensees are permitted to provide a statement of intent containing a cost estimate for decommissioning and indicating that funds for decommissioning will be obtained when necessary (10 CFR 50.75).

NRC regulations do not require the applicant to inform the NRC of its plans for decommissioning the facility at either the construction permit or operating license stage; consequently, no definite plan for the decommissioning of the plant has been developed. Rulemaking published on July 26, 1996, The regulations in 10 CFR 50.82(a)(1) requires a licensee who has decided to permanently cease operations to submit written certification to the NRC within 30 days of the decision or requirement to permanently cease operations. Once the fuel has been permanently removed, the licensee must provide a certification of this event to the NRC. At this point, the 10 CFR Part 50 license would no longer authorize operation of the reactor or allow the replacement of the fuel into the reactor vessel (10 CFR 50.82(a)(2)). Within 2 years following permanent cessation of operations, the licensee is required to submit a post-shutdown decommissioning activities report (PSDAR), which contains a description of the licensee's planned decommissioning activities, a schedule for the accomplishment of significant milestones, and an estimate of expected costs (10 CFR 50.82(a)(4)). The PSDAR also contains the documentation that the environmental impacts associated with the site-specific decommissioning activities have been considered in previously approved environmental impacts. If

the environmental impacts that are identified have not been considered in existing environmental assessments, the licensee will address the impacts in a request for a license amendment regarding the activities and must submit a supplement to the environmental report (ER) relating to the additional impacts.

No major decommissioning activities may be performed until 90 days after the NRC receives the PSDAR (10 CFR 50.82(a)(5)). The NRC will review the PSDAR, but NRC approval is not required. However, should the NRC determine that the PSDAR is deficient (not consistent with the information requirements given in the regulations), the NRC will inform the licensee of the deficiencies in writing and require that the deficiencies be addressed before initiation of major decommissioning activities.

A licensee wishing to terminate its license would submit a license termination plan for approval similar to the approach that is considered for a decommissioning plan. The license termination plan must be a supplement to the final safety analysis report (FSAR) or equivalent and must be submitted at least 2 years before termination of the license date (10 CFR 50.82(a)(9)). The rule requires that the license termination plan includes (1) a site characterization, (2) identification of any remaining dismantlement activities, (3) plans for site remediations, (4) detailed plans for the final radiation survey, (5) a description of the end use of the site, if restricted, (6) an updated site-specific estimate of remaining decommissioning costs, and (7) a supplement to the ER. The supplement to the ER would update the "Applicant's Environmental Report—Operating License Stage" to reflect any new information or significant environmental change associated with the proposed decommissioning activities (*Decommissioning of Nuclear Power Reactors*, 61 FR 39278 [NRC 1996d]).

Studies of social and environmental effects of decommissioning large commercial power generating units have not identified any significant impacts beyond those considered in the GEIS on decommissioning and the site-specific FEIS for the facility (NRC 1996b). Decommissioning of a nuclear facility generally has a positive environmental impact. The major environmental impact is the commitment of small amounts of land for waste burial in exchange for the potential reuse of the land where the facility is located (NRC 1996b). Each alternative will have radiological impacts associated with the transportation of radioactive material, but those should be no different from those associated with transportation impacts during normal facility operation. Also, studies indicate that occupational radiation doses can be controlled to levels comparable to occupational doses experienced with operating reactors through the use of appropriate work procedures, shielding, and remotely controlled equipment. To date, experience at decommissioned facilities has shown that the occupational exposures during the decommissioning period are comparable to those associated with refueling and routine maintenance of the facility when operational.

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5.10 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING OPERATION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's summarization of potentially adverse environmental impacts of plant operation, measures and controls to limit adverse impacts of project operation committed to by the applicant, and the staff's evaluation of those measures and controls. The scope of the review directed by this plan includes evaluation of those measures and controls proposed or committed to by the applicant for feasibility and adequacy in limiting impacts. The result of this review should be a table listing the potentially adverse impacts, the applicant's commitments, and the staff's evaluations.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 5.1.1 through 5.8.3. Obtain lists of potentially adverse impacts of plant operation.
- ESRP 5.2.1. Obtain a list of measures and controls to limit or minimize hydrologic alterations from the proposed action.
- ESRP 6.7. Obtain a list of those monitoring programs that will permit application of adequate measures and controls to limit adverse environmental impacts of plant operation.

- ESRPs 9.4.1, 9.4.2, and 9.4.3. Provide a list of appropriate measures and controls to limit adverse impacts so those measures and controls can be considered and evaluated.

- ESRP 10.1. Provide a list of those adverse environmental impacts that cannot be mitigated or for which mitigation is not practical.

- ESRPs 10.2 and 10.3. Provide a list of the irreversible and irretrievable commitments of resources as determined by this point in the review process.

- Project Manager's Handbook. Consult with the *Project Manager's Handbook* (NRC 1989), NUREG/BR-0073, Rev. 1, for information on applicant commitments and their applicability with and linkage to ESRP 5.10.

- Interface with Environmental Project Manager (EPM). Consult with the EPM on adverse impacts, as discovered in the reviews of ESRP Chapter 5.0, that are likely to result from operation of the proposed plant and are identified through the analysis. Present potential mitigation measures and their merits as they are identified.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- staff listing of potentially adverse impacts

- the proposed design or planned control program

- the proposed control or operational procedures

- the following from the environmental report (ER):

  - noise
  - erosion
  - effluents and wastes
  - surface-water impacts
  - groundwater impacts
  - terrestrial ecosystem impacts
  - aquatic ecosystem impacts
  - socioeconomic impacts
  - other site-specific impacts.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the summary of the measures to monitor and control potentially adverse impacts of operation are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A to Subpart A, with respect to discussion of alternatives and mitigating measures to avoid or minimize adverse impacts.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the measures planned to reduce undesirable effects of station operation.

Technical Rationale

The technical rationale for evaluating the applicant's commitment to monitor and control adverse impacts during plant operation is discussed in the following paragraph:

Evaluation of the proposed action includes identification and evaluation of the potentially adverse impacts of plant operation. This review results in a summary of the potentially adverse impacts and lists the applicant's commitments to measures and controls to limit adverse impacts during operation. The applicant's commitments should be compared with the list of potentially adverse impacts identified by the staff and evaluated for efficacy to determine those impacts that cannot be avoided or mitigated. A list of those adverse impacts that cannot be avoided or mitigated should be provided to the reviewer for ESRP 10.1.

III. REVIEW PROCEDURES

The reviewer's analysis should include identification and tabulation of operational impacts requiring mitigation, identification of the applicant's commitments that limit and control these impacts, and comparison of the applicant's commitments with impacts requiring mitigation. The reviewer should take the following steps:

(1) Identify and tabulate the operational impacts (see the reviewers for ESRPs 5.1 through 5.8) that are of sufficient severity to need mitigation, i.e., measures and controls to limit the impact.

(2) List the applicant's commitments for mitigating the impact.

(3) Identify, based on consultation with appropriate staff reviewers, the applicant's commitments that will satisfy the staff's concerns for mitigation.

(4) When you determine that there are no appropriate applicant commitments to control or limit an adverse impact, consult with reviewers for the appropriate ESRPs 5.1.1 through 5.8.3, the reviewers for ESRPs 9.4.1 through 9.4.3, and the EPM to identify mitigation measures. Note those impacts for which no appropriate measures and controls to limit the impact can be identified.

(5) Prepare a table similar to Table 5.10-1 to compare potentially adverse operational impacts with the applicant's commitments for measures and controls to limit the impacts. Identify adverse impacts that cannot be mitigated or for which mitigation is not practical.

(6) Confirm that the operational impacts, when considered on a site-specific basis, are adverse and should be mitigated.

- Make this determination through consultation with the appropriate reviewers for ESRPs 5.1.1 through 5.8.3.

- Take into account experience gained from the review of operational data from other plants having similar impacts.

- Ensure that adequate documentation is available to support the staff conclusions with respect to the nature and severity of those impacts requiring mitigation.

(7) Confirm that the available measures and controls to limit each impact have been evaluated to verify that a practical level of mitigation can be achieved by these methods and controls.

- Confirm that each measure and control is reasonable, i.e., involves methods and techniques that are appropriate and achievable on a site-specific basis.

- Confirm that the measures and controls are specific and unambiguous, and are structured so that their application and results can be verified through subsequent field reviews and inspections.

(8) Confirm that environmental, economic, and social costs of the available measures and controls have been balanced against the benefits expected.

- Consult with appropriate benefit-cost reviewers in conducting this portion of the evaluation. Benefit-cost reviews cannot be used as a basis for noncompliance with NRC regulations.

- When mitigation techniques do not lead to an improvement in the overall benefit-cost ratio, and if mitigation is not required by law, the impact may be accepted without mitigation and considered in the overall project benefit-cost balancing.

IV. EVALUATION FINDINGS

This review should summarize (1) adverse impacts of operation for which measures and controls to limit the impacts can be applied, (2) the applicant's commitments to limit these impacts, and (3) the staff's evaluation of the potentially adverse impacts and the applicant's measures and controls to limit adverse impacts. The results of this review will also be used by the reviewer for ESRP 10.1 to describe the unavoidable adverse impacts of operation. The input to the EIS should include the following:

- a summary of the potentially adverse impacts of operation for which measures and controls to limit the impacts can be applied
- a description of the applicant's commitments for measures and controls to limit adverse impacts
- the staff's evaluation of applicant's commitment related to each impact.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1989. *Project Manager's Handbook*, NUREG/BR-0073, Rev. 1, Washington, D.C.

Table 5.10-1. Summary of Potentially Adverse Impacts of Operation

Impact	Impact Description	Applicant's Commitment	Staff Evaluation
Land-use impacts	impact 1	commitment a	evaluation α
	impact 2	commitment b	evaluation β
Hydrological and water-use impacts	impact 3	commitment c	evaluation γ
	impact 4		There are no practical measures for mitigation of this impact. The impact will be considered in the evaluation of unavoidable adverse environmental impacts.

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6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the environmental measurements and monitoring programs. The scope of the paragraph covered by this plan is to introduce the material from the reviews conducted under ESRPs 6.1 through 6.7.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulation identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's environmental measurements and monitoring program is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of the data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 6.1 through 6.7. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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6.1 THERMAL MONITORING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of the applicant's preoperational and operational thermal monitoring programs. If elements of the monitoring program are determined to be inadequate, staff evaluations of potential supplemental programs should be presented.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain descriptions of the hydrology of the region surrounding the proposed plant site.
- ESRP 2.3.2. Obtain descriptions of the regional water uses (e.g., the location and nature of water users and water-use areas) for the area surrounding the proposed plant site.
- ESRP 3.4. Obtain descriptions of the cooling system of the proposed plant.
- ESRPs 4.2 and 5.2. Obtain descriptions of preoperational baseline thermal monitoring programs that were developed and evaluated based on analyses of the impacts of hydrological alterations, plant water supply, and water-use changes caused by plant construction or operation.

- ESRP 5.3.2. Obtain descriptions of the thermal effects (on the receiving water bodies) of discharges from the plant's cooling system. Also obtain a discussion of any preoperational baseline thermal monitoring programs necessary to assess physical impacts of the discharge system operation.

- ESRP 6.7. Provide a list of evaluated additions or deletions to the applicant's proposed monitoring programs.

Data and Information Needs

The type of data and information needed will be specified by the National Pollutant Discharge Elimination System (NPDES) administrative agency. Site- and station-specific factors and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- maps showing (1) features of the plant and site, including the boundaries and bathymetry of all water bodies adjacent to the site both before and after construction activities, (2) the location of all thermal, hydrological, or aquatic biological monitoring stations, and (3) the predicted extent of the thermal plume (from the environmental report [ER])

- the type and frequency of temperature measurements taken at each location, as well as the duration of each monitoring program (from the ER)

- descriptions of the monitoring equipment used (from the ER)

- descriptions of the data analysis procedures used (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the thermal programs on the proposed sites are based on the relevant requirements of the following:

- 33 CFR 322 with respect to defining activities requiring permits

- 33 CFR 330, Appendix A, with respect to conditions, limitations, and restrictions on construction activities

- 40 CFR 6, Appendix A, with respect to procedures on floodplain and wetlands protection

- 40 CFR 122 with respect to NPDES permit conditions for discharges, including storm water discharges

- 40 CFR 149 with respect to possible supplemental restrictions on waste disposal and water use in or above a sole source aquifer

- 40 CFR 423 with respect to effluent limitations on existing and new point sources

- Federal, State, local, regional, and Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Compliance with environmental quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts of striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will establish its own impact determination.

- Because water quality and water supply are interdependent, changes in water quality must be considered simultaneously with changes in water supply. In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the States' role in regulating water rights.

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the format and content of ERs, including hydrology, water-use, and water-quality issues.

The regulatory position necessary to meet the objective identified above requires documentation of consultations with NPDES authority.

Technical Rationale

The technical rationale for evaluating the applicant's thermal monitoring program is discussed in the following paragraphs:

A detailed and thorough description of the thermal monitoring is essential for the evaluation of potential impacts to the environment that may result from plant construction and operation.

Adequate monitoring (baseline and operational) is generally a prerequisite for obtaining or renewing an NPDES permit.

III. REVIEW PROCEDURES

The reviewer should consider the following separate but related aspects of the applicant's thermal monitoring program:

- Preapplication Monitoring. The program of field monitoring and data collection is used to support the applicant's thermal descriptions.

- Preoperational Monitoring. The program of thermal monitoring establishes a baseline for identifying and assessing environmental impacts resulting from plant operation.

- Operational Monitoring. The program of thermal monitoring establishes changes in water temperature resulting from plant operation.

Each of these aspects is discussed in greater detail in the sections that follow.

Preapplication Monitoring

Information from the applicant's preapplication monitoring program is used to aid in the description of the baseline water temperature. Generally, data are needed on a seasonal basis and should be sufficient to characterize seasonal variations throughout an annual cycle. Long-term trends may be established using regional data; the reviewer may rely on input from other sources (e.g., Federal, State, regional, local, or Native American tribal agencies) for these data.

The reviewer should analyze the available data to determine that they are adequate to support the environmental descriptions of ESRP 2.3.1 and the impact analyses of ESRPs 5.2 and 5.3.2. The following factors should be considered in the analysis:

- the location and number of monitoring stations as required to consider the following factors:

  - bathymetric characteristics in the vicinity of the site
  - type of cooling system employed and its probable operating modes
  - transient hydrological parameters in the vicinity of the site
  - vertical and horizontal temperature and salinity structure in the vicinity of the site.

- the sampling frequency and times to ensure that important temporal variations (e.g., tidal variations) are adequately monitored

- the duration of monitoring programs

- the data analysis procedures.

- data quality objectives (if any)

Preoperational Monitoring

The preoperational monitoring program supplements any preapplication monitoring in providing a baseline water temperature database. Discussion of the applicant's preoperational monitoring plan should mention the following:

- the average and extreme extent and enclosed surface area of the limiting excess temperature isotherms as established by the NPDES permitting agency, by comparison with background and baseline data
- temperatures at positions appropriate to define the extent of the mixing zones (proposed or established)
- time temperature relationships at biological monitoring stations
- any other parameters required by the NPDES permitting agency
- data quality objectives (if any).

Operational Monitoring

The operational monitoring program is designed to establish changes in water temperature resulting from plant operation. NPDES permitting agencies will specify operational monitoring requirements. The reviewer should describe the status of NPDES permit consultations and NPDES permit renewal.

IV. EVALUATION FINDINGS

Input from the ESRP 6.1 review to the environmental impact statement (EIS) should describe results of the preapplication monitoring program review and should present the objectives of the preoperational monitoring program without detail. The reviewer should briefly outline monitoring station locations and methods, frequency, and duration of sampling used. Tables and maps may be used if appropriate.

The reviewer should verify that sufficient information has been provided in accordance with the relevant requirements and that the evaluation supports the following type of statement to be included in the EIS:

> Based on the applicant's description of the preapplication preoperational and operational thermal monitoring program, the staff concludes that the thermal monitoring program is adequate to evaluate impacts on the affected environment.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

33 CFR 330, Appendix A, "Nationwide Permit and Conditions."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 149, "Sole Source Aquifers."

40 CFR 423, "Steam Electric Power Generating Point Source Category."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1037; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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6.2 RADIOLOGICAL MONITORING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and evaluation of the applicant's proposed radiological environmental monitoring program.

The scope of the review directed by this plan includes evaluation of the adequacy of the proposed program to characterize the radiological environment of the biosphere in the vicinity of the site, to provide data on measurable levels of radiation and radioactive materials in the site environs, and to provide baseline data on surveillance of principal pathways of exposure to the public. If elements of the monitoring program are determined to be inadequate, staff evaluations of potential supplemental programs should be presented.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 2.3.1 and 2.3.2. Obtain input from the reviewers of ESRPs 2.3.1 and 2.3.2 to verify the adequacy of ground and surface-water sampling points.
- ESRP 2.7. Obtain input from the reviewer for ESRP 2.7 to verify that air monitoring and sample points are adequately located.
- ESRP 3.5. Obtain the radiological effluent points.

- ESRP 5.4.1. Obtain the principal radiological exposure pathways.

- ESRP 6.7. Provide a summary of additions, modifications, or deletions to the proposed radiological environmental monitoring program.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential radiological impacts of the radioactive effluents from the plant. The following data or information should be obtained:

- a map or aerial photograph of the site vicinity with proposed monitoring and sampling locations clearly identified and keyed to indicate the medium sampled at each location. The map or photograph should be suitable to show distance and direction of each location from the plant, particularly with regard to the effluent release points (from the environmental reports [ERs]).

- a detailed description of the proposed monitoring program including (1) number and location of sample collection points and measuring devices and the pathway sampled or measured, (2) sample size, sample collection frequency, and sampling duration, (3) type and frequency of analysis, (4) general types of sample collection and measuring equipment, (5) lower limit of detection for each analysis, (6) the approximate date on which the proposed program will be effective, and (7) the quality-assurance program for radiological environmental monitoring programs (from the ER)

- a discussion justifying the choice of sample sites, analyses, sampling frequencies, sampling and measuring durations, sample sizes, and lower limits of detection (from the ER)

- principal radiological exposure pathways (from ESRP 5.4.1)

- radioactive effluent release points (from ESRP 3.5).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the radiological environmental measurements and monitoring programs are found in the following:

- Regulatory Guide 4.1, Rev.1, *Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants* (NRC 1975), with respect to establishing a program for monitoring radioactive materials from a reactor in the environment

- Regulatory Guide 4.15, Rev.1, *Quality Assumptions for Radiological Monitoring Programs (Normal Operations)—Effluent Streams and the Environment* (NRC 1979a), with respect to establishing an appropriate quality assurance program for the radiological environmental monitoring program

- Radiological Assessment Branch Technical Position regarding Radiological Environmental Monitoring Programs, Rev. 1, *Radiological Assessment Branch Technical Position* (NRC 1979b).

Technical Rationale

The technical rationale for evaluating the applicant's radiological monitoring program is discussed in the following paragraph:

The purpose of a radiological environmental monitoring program is to provide a basis for evaluating concentrations of radioactive materials and radiation levels in the environment from radiological releases once a reactor is operational. A well designed and well implemented environmental program will characterize the environment before operations so that a reasonable comparison can be made after the reactor is operating. The preoperational program can also be used for all or some of the operational radiological environmental monitoring program.

III. REVIEW PROCEDURES

The following analysis procedures include a review of the applicant's proposed preoperational radiological environmental monitoring program and the applicant's operational monitoring program, as appropriate. The preoperational program should establish (or may have established) the baseline from which subsequent identification and assessment of radiological environmental impacts resulting from plant operation can be made.

(1) Compare the applicant's proposed program (including quality assurance) with the basic criteria of Regulatory Guides 4.1 and 4.15 and the recommended program elements of the NRC Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program." The discussion of radiological environmental monitoring from the Branch Technical Position document is reproduced in Table 6.2-1.

(2) Consider the following factors in the analysis:

- If a preoperational program is under consideration, it should be based on the development of baseline data for important pathways and the anticipated types and quantities of radionuclides to be released from the plant.
  - The purposes of the premonitoring program are to measure background levels and their variations along the anticipated critical pathways in the area surrounding the station; to train personnel; and to evaluate procedures, equipment, and technique.
  - The preoperational monitoring program should be initiated 2 years before plant operation. (See Table 6.2-1 to this ESRP for recommended program durations.)

Table 6.2-1. Duration of Preoperational Program for Specific Media

6 Months	1 Year	2 Years
• Airborne iodine • Iodine in milk (while animals are in pasture)	• Airborne particulates • Milk (remaining analyses) • Surface water • Groundwater • Drinking water	• Direct radiation • Fish and invertebrates • Food products • Sediment from shoreline

The elements (sampling media and type of analysis) of both preoperational and operational programs should be essentially the same.

- If an operational program is under consideration, it should be based on baseline data already developed for important pathways and types and quantities of radionuclides released from the plants.

  - The program should be developed from baseline data that have already been obtained.

  - Consider adjustments being proposed by the applicant, based on operating experience.

  - The program should provide baseline data to evaluate the possibility of buildup of long-lived radionuclides in the environment and to identify potential physical and biological sites of radionuclide accumulation.

  - The program should establish the baseline from which correlations between levels of radiation and radioactivity in the environment and radioactive releases from plant operation may be made.

- The monitoring program should include a documented quality assurance program.

(3) Consult with the reviewer for ESRP 5.4.1 to identify the significant pathways of radiological impact to man and biota, e.g., food, recreational use, water use.

(4) Consult with the reviewer for ESRP 3.5 to determine the locations of effluent release points and orientation of the plant and any radioactive material storage locations.

(5) Consult with the reviewers for ESRPs 2.3.1, 2.3.2, and 2.7 to analyze the relationship between the proposed (or actual) effluent release point locations and the proposed (or actual) water and air sampling locations from the standpoint of detection of potential (or actual) buildup of radioactive materials from effluents. Use the site visit to observe the location of proposed (or actual) sampling and measuring locations relative to potential (or actual) radiological impact pathways.

(6) Determine whether sufficient and adequate information has been provided to analyze and evaluate the proposed radiological environmental monitoring program and, if it has, whether the proposed program will accomplish the stated goals and objectives.

(7) Consult with the reviewers for ESRP 2.3.1 and 2.3.2 to verify that ground and surface-water sampling points are located to best detect potential (or actual) concentrations of radioactive materials associated with liquid effluents.

(8) Consult with the reviewer for ESRP 2.7 to verify that air monitoring and sample points are located to best detect potential (or actual) concentrations of radioactive materials from airborne effluents. Determine whether sampling frequency and duration, sample size, and lower limits of detection are appropriate for the pathway being monitored.

(9) If the program is judged to deviate from these criteria, identify program additions or modifications, including changes in locations, additions of sampling and measurement stations, or deletion of some measurements.

(10) When a preoperational program is being considered, ensure that

(a) each important pathway of radiological impact to man will be monitored

(b) each monitoring program element will accumulate meaningful baseline data from which subsequent operational radiological impacts may be determined and controlled.

(11) When changes to an operational program are being considered, evaluate the technical merit of the applicant's justification.

IV. EVALUATION FINDINGS

Input from the ESRP 6.2 review to the environmental impact statement (EIS) should contain a brief description of the applicant's proposed radiological environmental monitoring program and the staff's conclusions with respect to its adequacy. The program (as approved by the staff) should be summarized and presented in a tabular format similar to that shown in Table 6.2-2. When the staff concludes that the applicant's proposed program should be amended, all identified changes should be listed separately so that they may be considered as part of the required program.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

Table 6.2-2. Radiological Environmental Monitoring Program

Exposure Pathway and Sample	Number of Samples[a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: Samples from 3 offsite locations (different sectors) of the highest calculated annual average D/Q.		Radioiodine canister: analyze weekly for I-131
	1 sample from the vicinity of a community having the highest calculated annual average D/Q.	Continuous sampler operation with sample collection weekly or as required by dust loading, whichever is more frequent[d]	Particulate Sampler: Gross beta radioactivity following filter change,[b] composite (by location) for gamma isotopic[c] quarterly
	1 sample from a control location (15-30 km distant and in the least prevalent wind direction)[e]		
DIRECT RADIATION[f]	2 or more dosimeters or 1 instrument for measuring and recording dose rate continuously to be placed at each of the same locations as for air particulates and at each of 3 additional offsite locations (different sectors) of highest calculated annual average ground-level χ/Q.	Monthly or quarterly	Gamma dose monthly or quarterly
WATERBORNE RADIATION			
Surface[g]	1 sample upstream 1 sample downstream	Composite sample over 1-month period[h,i]	Gamma isotopic analysis monthly. Composite for tritium analyses quarterly
Ground	Samples from 1 or 2 sources only if likely to be affected[j]	Quarterly	Gamma isotopic and tritium analysis quarterly

Table 6.2-2. Radiological Environmental Monitoring Program (contd)

Exposure Pathway and Sample	Number of Samples[a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
Drinking	1 sample of each of 1 to 3 of the nearest water supplies that could be affected by its discharge	Composite sample over 2-week period[f] if I-131 analysis is performed, monthly composite otherwise	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year. Composite for gross beta and gamma isotopic analyses monthly. Composite for tritium analyses quarterly
	1 sample from a control location		
Sediment from Shoreline	1 sample from downstream area with existing or potential recreational value	Semiannually	Gamma isotopic analyses semiannually
RADIATION BY INGESTION			
Milk	Samples from milking animals in 3 locations within 5 km distant having the highest dose potential. If there are none, 1 sample from milking animals in each of 3 areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per year	Semiannually when animals are on pasture; monthly at other times	Gamma isotopic and I-131 analysis semiannually when animals are on pasture; monthly at other times
	1 sample from milking animals at a control location (15-30 km distant and in the least prevalent wind direction)		
Fish and Invertebrates	1 sample of each commercially and recreationally important species in vicinity of discharge point	Sample in season or semiannually if species is not seasonable	Gamma isotopic analysis on edible portions
	1 sample of same species in areas not influenced by plant discharge		

Table 6.2-2. Radiological Environmental Monitoring Program (contd)

Exposure Pathway and Sample	Number of Samples[a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
Food Products	1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged	At time of harvest[k]	Gamma isotopic analysis on edible portion. I-131 analysis on green leafy vegetables
	3 samples of broadleaf vegetation grown nearest an offsite location of the highest calculated annual average ground-level D/Q if milk sampling is not performed	Monthly when available	
	1 sample of each of the similar vegetation grown 15-30 km distant in the least prevalent wind direction if milk sampling is not performed	Monthly when available	

(a) The number, media, frequency, and location of sampling may vary from site to site. It is recognized that, at times, it may not be possible or practical to obtain samples of the media of choice at the most desired location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and submitted for acceptance. Actual locations (distance and direction) from the site shall be provided. Refer to Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants."

(b) Particulate sample filters should be analyzed for gross beta 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air or water is greater than 10 times the mean of control samples for any medium, gamma isotopic analysis should be performed on the individual samples.

(c) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(d) Canisters for the collection of radioiodine in air are subject to channeling. These devices should be carefully checked before operation in the field, or several should be mounted in series to prevent loss of iodine.

(e) The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites that provide valid background data may be substituted.

Table 6.2-2. Radiological Environmental Monitoring Program (contd)

Exposure Pathway and Sample	Number of Samples[a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
(f) Regulatory Guide 4.13, Rev. 1, *Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications* (NRC 1977), provides minimum acceptable performance criteria for thermoluminescence dosimetry (TLD) systems used for environmental monitoring. One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescence dosimeter may be considered to be one chip, and two or more chips in a packet may be considered as two or more dosimeters. (g) The "upstream sample" should be taken at a distance beyond significant influence of the discharges. The "downstream" sample should be taken in an area beyond but near the mixing zone. "Upstream" samples in an estuary must be taken far enough upstream to be beyond the plant influence. (h) Generally, saltwater is not sampled except when the receiving water is used for recreational activities. (I) Composite samples should be collected with equipment (or equivalent) that is capable of collecting an aliquot at time intervals that are very short (e.g., hourly) relative to the composition period (e.g., monthly). (j) Groundwater samples should be taken when this source is tapped for drinking or irrigation purposes in areas in which the hydraulic gradient or recharge properties are suitable for contamination. (k) If harvest occurs more than once a year, sampling should be performed during each discrete harvest. If harvest occurs continuously, samples should be monthly. Attention should be paid to including samples of tuberous and root-food products.			

VI. REFERENCES

U.S. Nuclear Regulatory Commission (NRC). 1975. *Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants*. Regulatory Guide 4.1, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Performance, Testing, and Procedure Specifications for Thermoluminescence Dosimetry: Environmental Applications*. Regulatory Guide 4.13, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1979a. *Quality Assumptions for Radiological Monitoring Programs (Normal Operations)—Effluent Streams and the Environment*. Regulatory Guide 4.15, Rev. 1, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1979b. Radiological Assessment Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program," Rev. 1. PDR Accession No. 8001040390.

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6.3 HYDROLOGICAL MONITORING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description and evaluation of the applicant's preapplication, site preparation and construction, preoperational, and operational hydrological monitoring programs. The scope of the review directed by this plan includes evaluations of (1) the accuracy of data, (2) adequacy of data collection, and (3) analytical methods used in the hydrological monitoring programs. If elements of the monitoring programs are determined to be inadequate, identification and evaluation of potential supplemental programs should be prepared.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.1. Obtain descriptions of the hydrology of the region surrounding the proposed plant site.
- ESRP 2.3.2. Obtain descriptions of the regional water uses (e.g., the location and nature of water users and water-use areas) for the area surrounding the proposed plant site.
- ESRP 3.4. Obtain descriptions of the cooling system of the proposed plant.
- ESRPs 4.2 and 5.2. Obtain descriptions of preoperational baseline hydrologic monitoring programs that were developed and evaluated, based on analyses of the impacts of hydrological alterations, plant water supply, and water-use changes caused by plant construction or operation.

- ESRP 4.3.2. Obtain descriptions of programs for monitoring the impacts of the proposed plant operations on aquatic ecosystems that were identified and evaluated.

- ESRPs 5.3.1 and 5.3.2. Obtain descriptions of the hydrologic effects of intakes to and discharges from the plant's cooling system. Obtain a discussion of any preoperational baseline hydrologic monitoring programs necessary to assess physical impacts of the intake and discharge system operation.

- ESRP 6.7. Provide a list of evaluated additions or deletions to the applicant's proposed monitoring programs.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- maps showing (1) features of the plant and site, including the boundaries and bathymetry of all surface-water bodies (including springs) adjacent to the site both before and after construction activities, (2) the locations of all hydrological (including groundwater monitoring wells), thermal, and aquatic biological monitoring stations, (3) locations of all wells potentially influenced by plant construction and operation, and (4) major geomorphic features (e.g., floodplains) and regional geology (from the environmental report [ER])

- site vicinity surface and groundwater average and extreme velocities and flow rates (from ESRP 2.3.1 and the ER)

- sediment transport (suspended and bed load) characteristics and erodability of the site soil (from ESRP 2.3.1 and the ER)

- the type and frequency of data collected at each location as well as the duration of each monitoring program (from the ER)

- descriptions of the monitoring equipment used (from the ER)

- descriptions of the data analysis procedures used (from the ER)

- documentation of data quality objectives (if any) (from ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of thermal monitoring programs are based on the relevant requirements of the following:

- 33 CFR 322 with respect to definition of activities requiring permits
- 33 CFR 330, Appendix A, with respect to conditions, limitations, and restrictions on construction activities
- 40 CFR 6, Appendix A, with respect to procedures on floodplain and wetlands protection
- 40 CFR 122 with respect to NPDES permit conditions for discharges including storm water discharges
- 40 CFR 149 with respect to possible supplemental restrictions on waste disposal and water use in or above a sole source aquifer
- 40 CFR 423 with respect to effluent limitations on existing and new point sources
- Federal, State, regional, local, and Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Compliance with environmental quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act (CWA) is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action that are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts of striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will establish its own impact determination.
- Because water quality and water supply are interdependent, changes in water quality must be considered simultaneously with changes in water supply. In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the States' role in regulating water rights.
- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the format and content of Environmental Reports including hydrology, water-use, and water-quality issues.

The regulatory position necessary to meet the objective identified above requires documentation of consultations with National Pollution Discharge Elimination System (NPDES) administrative authority, and/or water rights regulatory authority.

Technical Rationale

The technical rationale for evaluating the applicant's hydrological monitoring program is discussed in the following paragraphs:

A detailed and thorough description of the hydrological monitoring is essential for the evaluation of potential impacts to the environment that may result from plant construction and operation.

Effluents discharged to navigable streams are governed by the CWA, 40 CFR 122, 40 CFR 423, and State water-quality standards. A NPDES permit to discharge effluents to navigable streams pursuant to Section 402 of CWA may be required for a nuclear power station to operate in compliance with the Act, but it is not a prerequisite to an NRC license. Adequate monitoring (baseline and operational) is generally a prerequisite for obtaining or renewing an NPDES permit.

III. REVIEW PROCEDURES

The reviewer should consider the following separate but related aspects of the applicant's hydrological monitoring program:

- Preapplication Monitoring. The program of field monitoring and data collection is used to support the applicant's baseline hydrological descriptions.
- Construction Monitoring. The program of hydrological monitoring to control anticipated impacts from site preparation and construction and to detect any unexpected impacts arising from these activities may include preconstruction monitoring to establish a baseline for assessing the subsequent impacts of site preparation and construction. This monitoring will be needed only in unusual circumstances when specific adverse impacts are predicted.
- Preoperational Monitoring. The program of hydrological monitoring establishes a baseline for identifying and assessing environmental impacts resulting from plant operation.
- Operational Monitoring. The program of hydrological monitoring establishes the impacts of operation of the plant and detects any unexpected impacts arising from plant operation.

Each of these aspects is discussed in greater detail below. If available, documentation of data quality objectives should be reviewed.

Preapplication Monitoring

Information from the applicant's preapplication monitoring program is used to aid in the assessment of site acceptability and to support the staff's database as needed to identify surface-water or groundwater system impacts that could result from construction and operation of the proposed plant. Generally, data are needed on a seasonal basis and should be sufficient to characterize seasonal variations throughout at least one annual cycle.

The reviewer should analyze the available data to determine that they are adequate to support the environmental descriptions of ESRP 2.3 and the impact analyses of ESRPs 4.2, 5.2, 5.3.1, and 5.3.2. The following factors should be considered in the analysis:

- the location and number of monitoring stations (and wells) as required to consider the following factors:
  - bathymetric characteristics of surface waters in the site vicinity
  - soil and groundwater system characteristics in the site vicinity
  - the type of cooling system employed and its operating modes
  - type of sanitary and chemical waste retention method
  - transient hydrological and meteorological parameters in the site vicinity.
- the sampling frequency and times to ensure that important temporal variations (e.g., tidal variations and intense rainfall) are adequately monitored
- the duration of monitoring programs
- the sediment transport characteristics.

Construction Monitoring

Construction monitoring will be required when specific adverse impacts are predicted (e.g., impact due to dewatering, increased turbidity). The reviewer should determine these predicted impacts from the ESRP 4.2 and 4.3 reviews and should analyze the proposed monitoring programs associated with these predicted impacts.

Preoperational Monitoring

The preoperational monitoring program is designed to provide the database necessary for evaluating any hydrologic changes arising from operation of the proposed plant. The applicant's preoperational monitoring plan should be analyzed to determine if adequate baseline data will be available to assess the following:

- the alteration of surface-water flow fields in the site vicinity

- alteration of groundwater flow (e.g., saltwater intrusion)
- impact of sanitary and chemical waste-retention methods on groundwater quality
- alteration of sediment transport
- alteration of floodplains or wetlands.

Operational Monitoring

The operational monitoring program is designed to establish the impacts of operation of the plant and to detect any unexpected impacts arising from plant operation. Operational monitoring may be required by permitting agencies.

IV. EVALUATION FINDINGS

Input from the ESRP 6.3 review to the environmental impact statement (EIS) should describe results of the preapplication monitoring program review and should present the objectives of the site preparation, construction, and preoperational hydrological monitoring programs without detail. The reviewer should briefly outline monitoring station locations and the methods, frequency, and duration of monitoring used in each case. Tables and maps may be used if appropriate.

The reviewer's evaluation of these monitoring programs should establish whether sufficient and adequate data will be provided to accomplish the goals of the programs as outlined above. If the program is judged to be inadequate or to contain unnecessary elements, the reviewer should identify and evaluate additions and deletions as needed. The reviewer should ensure that all such additions and deletions are consistent with NRC policy and requirements established by the EPA or other Federal, State, regional, local, and affected Native American tribal agencies responsible for the determinations specified in the CWA. The following features should be evaluated when applicable:

(1) the intensity of sampling needed for each anticipated impact. It should be commensurate with the degree of impact expected.

(2) validity of data

(3) compliance with requirements of Federal, State, regional, local, and Native American tribal agencies

(4) adequacy of measurement techniques.

Where data from an earlier monitoring program or project demonstrate no significant impacts, provisions to study such effects in successive monitoring programs may be reduced or deleted.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

33 CFR 330, Appendix A, "Nationwide Permit and Conditions."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination Systems."

40 CFR 149, "Sole Source Aquifers."

40 CFR 423, "Steam Electric Power Generating Point Source Category."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1037; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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6.4 METEOROLOGICAL MONITORING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description and evaluation of an applicant's meteorological monitoring program in sufficient detail to lead to decisions on site acceptability and, ultimately, plant construction and operational procedures.

The scope of the review directed by this plan includes evaluations of the adequacy and accuracy of data collection and analytical methods used in the meteorological monitoring program's review of the locations of towers, siting of sensors, sensor performance specifications, methods and equipment for recording sensor output, data acquisition and reduction procedures, and the quality assurance program for sensors, recorders, and data reduction.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 1.2. Obtain input from the reviewer for ESRP 1.2 to determine if the applicant has obtained Federal Aviation Administration (FAA) approval for construction of the meteorological tower if the tower extends more than 61 m (200 ft) above ground level.

- ESRP 2.7. Provide an evaluation of the adequacy of the applicant's meteorological monitoring program for obtaining data that are representative of the site.

- ESRP 5.5.1. Obtain a discussion of any requirements for preoperational monitoring programs that will be needed in establishing baselines for nonradiological system effluents.

- ESRP 6.7. Provide an assessment of the meteorological program.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a description of the onsite meteorological measurements programs (from the environmental report [ER])

- a description of all other data collection programs used to provide data for the description of atmospheric transport and diffusion characteristics within 80 km of the plant (from the ER)

- the following information for onsite programs and, as available, for offsite sources of meteorological data:

  - a map showing detailed topographic features of the site (as modified by the station), including major structures and the meteorological tower(s) used to describe the meteorological characteristics of the site and immediate vicinity (from ESRP 2.7)

  - a map showing the general topographic features and locations of offsite meteorological facilities, providing information characteristic of the region (from ESRP 2.7)

  - the type of meteorological measurements, including elevations of measurements above grade (from the ER)

  - a description of the instruments used, including performance specifications and starting thresholds of wind instrumentation (from the ER)

  - calibration and maintenance procedures, including frequency of performance of calibration and maintenance, and for the preapplication program, results of calibrations, major causes of instrument outage or drift from calibration, and corrective action taken (from the ER)

  - a description of data output and recording systems and locations of these systems with respect to the onsite program (from the ER)

  - data analysis procedures (from the ER), including computer programs used to screen hourly meteorological data for potential errors

- estimates of overall system accuracy for each meteorological parameter measured (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the onsite meteorological measurements program are based on the relevant requirements of the following:

- 10 CFR 50, Appendix I, with respect to meteorological data used in determining compliance with numerical guides for doses to meet the criterion of "as low as is reasonably achievable" (ALARA)
- 10 CFR 51.45(c) with respect to meteorological data provided to aid the Commission in its development of an independent analysis
- 10 CFR 51.50 with respect to keeping records of environmental data
- 10 CFR 52.17(a)(1) with respect to describing the meteorological characteristics of the proposed site in an early site permit application
- 10 CFR 100.10(c)(2) with respect to data collected for use in characterizing meteorological conditions of the site and surrounding area.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Section C of Regulatory Guide 1.23, *Onsite Meteorological Programs* (NRC 1972), contains specific criteria for an acceptable meteorological- measurement system.
- Appendix A of ESRP 2.7 describes an acceptable format for submission of meteorological data to NRC. Data may be submitted on magnetic tape or other media.
- Section C.4 of Regulatory Guide 1.111, Rev. 1, *Methods for Estimating Atmospheric transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors* (NRC 1977), contains guidance on summarization of meteorological measurements for use with models.
- Regulatory Guide 1.21, *Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluens from Light-Water-Cooled Nuclear Power Plants* (NRC 1974), contains guidance on summarization of meteorological data for submission with reports of releases of radioactive materials in gaseous effluents.

Technical Rationale

The technical rationale for evaluating the applicant's meteorological monitoring program is discussed in the following paragraphs:

10 CFR 50, Appendix I, 10 CFR 51.45(c), 10 CFR 52.17(a)(1), and 10 CFR 100.10(c)(2) require staff analyses that use onsite meteorological data. The staff considered this need for onsite data and established guidance for data collection systems to ensure that onsite data are representative. This guidance is in Section C of Regulatory Guide 1.23 (NRC 1972).

Staff evaluation of compliance with 10 CFR 50, Appendix I, and the independent evaluation of site meteorological characteristics under 10 CFR 100.10(c)(2), 10 CFR 100.20(c)(2), and 10 CFR 52.17(a)(1) is based on onsite meteorological data. The staff prepared a standard format for transferring meteorological data to the NRC. This format is defined in Appendix A of ESRP 2.7. Use of the standard format facilitates reliable data transfer.

Staff evaluation of the environmental impacts of routine releases of radioactive effluents to the environment uses various meteorological models. The models are described in Regulatory Guide 1.111 (NRC 1977). Section C.4 of this Guide describes summarization of meteorological data for use in the models.

Staff evaluation of the environmental impacts of releases of radioactive materials in gaseous effluents from nuclear power plants involves the use of onsite meteorological data. Regulatory Guide 1.21 (NRC 1974) describes acceptable formats for inclusion of meteorological data with reports of releases of radioactive materials in gaseous effluents.

III. REVIEW PROCEDURES

The reviewer should verify that sufficient information has been provided to adequately assess the onsite meteorological measurements program and other data-collection programs used by the applicant to (1) describe local and regional atmospheric transport and diffusion characteristics, (2) ensure environmental protection, and (3) provide an adequate meteorological database for evaluation of the effects of plant operation.

The reviewer should consider the following separate but related aspects of the applicant's meteorological monitoring program:

- Preapplication Monitoring. The program of field monitoring and data collection is used to support the applicant's meteorological descriptions.

- Site Preparation and Construction Monitoring. This is the proposed program of meteorological monitoring to control anticipated impacts from site preparation and construction and to detect any unexpected impacts arising from these activities. This program may include preconstruction monitoring to establish a baseline for assessing the subsequent impacts of site preparation and construction. This monitoring will be needed only in unusual circumstances when specific adverse impacts are predicted.

- Preoperational Monitoring. The program of meteorological monitoring establishes a baseline for identifying and assessing environmental impacts resulting from plant operation.

- Operational Monitoring. The program of meteorological monitoring establishes a baseline for use in evaluation of the environmental impacts of plant operation.

In terms of onsite meteorological instrumentation, the reviewer should ensure that the basic meteorological parameters measured by instrumentation at all sites include wind direction and wind speed at two levels, ambient air temperature difference between two levels, temperature, and atmospheric moisture at height(s) representative of water-vapor release (at sites at which large quantities of water vapor are emitted during plant operation). Guidance on meteorological data to be used as input to atmospheric dispersion modeling and assessment is given in Regulatory Guides 1.111 and 1.21.

With these considerations in mind, the reviewer should evaluate instrument siting, meteorological sensors, and the recording of their output, instrument surveillance, data acquisition and reduction, and data screening.

Instrument Siting

The reviewer should compare instrument types, heights, and locations to the recommendations of Regulatory Guide 1.23, Sections C.1 and C.2, as follows:

(Note: Additional guidance on instrument siting may be found in ANSI/ANS-2.5, "American National Standard for Determining Meteorological Information at Nuclear Power Sites," and in International Atomic Energy Agency Safety Series No. 50-5G-S3, "Atmospheric Dispersion in Nuclear Power Plant Siting" [IAEA 1980].)

(1) Evaluate local exposure of instruments, as follows:

(a) Examine the local exposure of the wind and temperature sensors to ensure that the measurements will represent the general site area after plant construction.

- Determine whether the tower that supports the sensors will influence the wind or temperature measurements.

- Keep the following guidelines in mind:

  - Professional experience and studies have shown that wind sensors should be mounted on booms so that the sensors are at least one (and preferably two or more) tower widths away from an open latticed tower and at least two stack or tower widths away from a stack or closed tower.

- For temperature sensors, mounting booms need not be as long as those for wind direction sensors, but the sensors must be unaffected by thermal radiation from the tower itself.

- No temperature sensors may be mounted directly on stacks or closed towers.

- Mounting booms for all sensors should be oriented normal to the prevailing wind at the site.

(b) Determine whether the terrain at or near the base of the tower will unnaturally affect the wind or temperature measurements.

- Evaluate the heat reflection characteristics of the surface underlying the meteorological tower (grass, soil, gravel, paving, etc.) to ensure that localized influences on measurements are minimal.

- Examine the position, size, and materials used in the construction of the recorder shelter and the proximity and heights of nearby trees and structures, including exhaust stream plumes, for potential localized influence on the measurements.

(2) Evaluate the general exposure of instruments as follows:

(a) Verify that the tower position(s) will allow the instrumentation to provide measurements that represent the overall site meteorology without plant structure interference.

(b) Determine and evaluate the representativeness of the locations, as follows:

- Examine topographic maps that have been modified to show the finished plant grade and features.

- Conduct a site visit.

- Use professional judgment on airflow patterns.

(c) Examine the plant structure layout, including structure heights and potential influence on meteorological measurements, using the following guidelines:

- For no discernible influence on measurements, towers should be located at least ten obstruction heights away from major obstructions.

- For towers located more than five obstruction heights from major obstructions, the influence should be minimal.

- Tower locations within five obstruction heights should be analyzed on a case-by-case basis.

Meteorological Sensors

The reviewer should evaluate meteorological sensors as follows:

(1) Evaluate sensor type and performance specifications.

(a) Consider manufacturers' specifications, performance analyses, and operating experience for these sensors in evaluating their accuracy and potential for acceptable data recovery.

(b) Use standardized evaluations and operational experience reports contained in research papers. Guidance for sensor evaluation is found in Regulatory Guide 1.23 and *Atmospheric Science and Power Production* (Randerson 1984).

(2) Determine the suitability of the specific type of sensor for use in the environmental conditions expected to occur at the site, by considering the range of wind conditions and the ability of the sensors to withstand corrosion, blowing sand, salt, air pollutants, birds, and insects.

(3) If the sensors are new and unique, consult a meteorological instrumentation expert (e.g., National Oceanic and Atmospheric Administration—Idaho National Engineering and Environmental Laboratory [NOAA–INEEL]) to complete the analysis.

Recording of Meteorological Sensor Output

The reviewer should evaluate the recording of the sensor output as follows:

(1) Evaluate the methods of recording (e.g., digital or analog, instantaneous or average engineering units or raw voltages) and recording equipment, including performance specifications and location of the equipment. Consider manufacturers' specifications and operating experience for the recorders when considering accuracy and the potential for acceptable data recovery.

(2) Review the controlled environmental conditions in which the recorders are kept (instrument shelter or control room) for adequacy in accordance with the manufacturers' specifications. Confirm the ability to obtain a direct readout from the recorders *in situ* during routine inspection of systems so that the reviewer will be able to relate the recorder output directly to what the sensor should be seeing. Some specific recommendations are contained in Regulatory Guide 1.23, Section C.3.

Instrumentation Surveillance

When evaluating instrumentation surveillances, the reviewer should do the following:

- Review the inspection, maintenance, and calibration procedures and their frequency.

- Compare the surveillance procedures and the frequency of attention that the instrumentation systems receive with operating experience at this site and at other sites with similar instrumentation to determine if acceptable data recovery with acceptable accuracy is likely throughout the duration of the meteorological program.

- Review calibration reports and results to determine sensor stability and accuracy over the period of data collection.

Guidelines for acceptable accuracy and acceptable data recovery are specified in Regulatory Guide 1.23, Sections C.4 and 5. Any deviations from Regulatory Guide 1.23 must be justified.

Data Acquisition and Reduction

To evaluate data acquisition and reduction, the reviewer should take the following steps:

(1) Review the procedures, including both hardware and software, for data acquisition and reduction. Because there are many methods of acquiring data from meteorological measurement systems, the review procedure varies. The following basic components of the program should be reviewed:

- accuracy of measuring in units of direct measurement and their precision

- accuracy in conversion of direct measurement units to meteorological units

- accuracies involved in frequency and mode (instantaneous or average) of sampling

- time over which system outputs are averaged for final data disposition and accuracy of these data.

(2) Because the instrument accuracy recommendations of Regulatory Guide 1.23 refer to overall system accuracy for instantaneous recorded values or time-averaged values, assess the overall system accuracy in addition to the component (sensor, recorder, and reduction) accuracies. The assessment should consist primarily of using statistical procedures for compound errors based on sensor accuracy, recorder accuracy, conversion of units accuracy, frequency and mode of sampling, and for error reduction by averaging.

Data Screening

In addition to the checks and calibration of the onsite meteorological instruments,

(1) Screen the recorded meteorological data to evaluate the data quality.

(2) Review the data screening programs and program output to determine data quality, data validity, and data recovery rate. Examples of data screening programs are contained in NUREG-0917, *Nuclear Regulatory Commission Staff Computer Programs for Use with Meteorological Data* (Snell 1982).

IV. EVALUATION FINDINGS

The depth and extent of the input to the environmental impact statement (EIS) should be governed by the environmental characteristics of meteorology that could be affected by plant construction and operation and by the nature and magnitude of the expected impacts to the atmospheric environment. The following information should be included in the EIS:

- a brief summary description of the onsite preapplication meteorological measurements program(s) and other data collection programs used by the applicant, including
  - height and location of meteorological sensors by type
  - period of data record
  - data recovery
  - period of data record and meteorological parameters used for atmospheric diffusion estimates.
- when required, a brief summary description of the proposed site preparation and construction meteorological monitoring program
- a brief summary description of the proposed preoperational meteorological monitoring program.

The reviewer should verify that sufficient information has been provided in accordance with the requirements of this ESRP and that the evaluation supports the following type of concluding statement, to be included in the staff's EIS:

> The staff reviewed the available information relative to the onsite meteorological measurements program and the data collected by the program. The staff concludes that the system provides adequate data to represent onsite meteorological conditions as required by 10 CFR 100.10 and 10 CFR 100.20. The onsite data also provide an acceptable basis for making estimates of atmospheric dispersion for design basis accident and routine releases from the plant to meet the requirements of 10 CFR 100.11, 10 CFR 50.34, and 10 CFR 50, Appendix I.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

10 CFR 50.34, "Contents, application, and technical information."

10 CFR 51.45, "Environmental report."

10 CFR 51.50, "Environmental report—construction permit stage."

10 CFR 52.17, "Contents of application."

10 CFR 100.10(c)(2) and 10 CFR 100.20(c)(2), "Factors to be considered when evaluating sites."

10 CFR 100.11, "Determination of exclusion area, low population zone, and population center distances."

American National Standards Institute/American Nuclear Society (ANSI/ANS)-2.5. 1990. "American National Standard for Determining Meteorological Information at Nuclear Power Sites."

International Atomic Energy Agency (IAEA). 1980. *Atmospheric Dispersion in Nuclear Power Plant Siting*, Safety Series No. 50-SG-S3, 1980.

Randerson, D. 1984. *Atmospheric Science and Power Production*. DOE/TIC-27601, U.S. Department of Energy, Washington, D.C.

Snell, W. 1982. *Nuclear Regulatory Commission Staff Computer Programs for Use with Meteorological Data*. NUREG-0917, U.S. Nuclear Regulatory Commission, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1972. *Onsite Meteorological Programs*. Regulatory Guide 1.23, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1974. *Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants*. Regulatory Guide 1.21, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*. Regulatory Guide 1.111, Rev. 1, Washington, D.C.

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6.5 ECOLOGICAL MONITORING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes ecological measurements and the ecological monitoring program. The scope of the paragraph covered by this plan is to introduce the material from the reviews conducted under ESRPs 6.5.1 and 6.5.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the ecological monitoring programs are based on meeting the intent of the relevant requirements of the following:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's ecological monitoring program is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 6.5.1 and 6.5.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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6.5.1 TERRESTRIAL ECOLOGY AND LAND USE

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description and evaluation of the applicant's preapplication, site preparation and construction, preoperational, and operational monitoring programs for terrestrial ecology and land use in sufficient detail to lead to decisions on site acceptability and, ultimately, plant construction and operational procedures. Monitoring programs should cover elements of the ecosystem for which a causal relationship between station construction and/or operation and adverse change is established or strongly suspected. The scope of the review directed by this plan includes evaluations of standardization, adequacy, and accuracy of data collection and analytical methods used in the terrestrial monitoring programs. If elements of the monitoring program are determined to be inadequate, staff evaluation of potential supplemental programs should be presented.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.4.1. Obtain appropriate information on the principal terrestrial ecological features of the site and vicinity.
- ESRP 3.1. Obtain information about the power plant's external appearance and layout from the reviewer of ESRP 3.1 in enough detail to support an analysis of the applicant's terrestrial ecology monitoring program.

- ESRP 3.4.1. Obtain a description of the cooling system and its operational modes from the reviewer of ESRP 3.4.1 in enough detail to support an analysis of the applicant's terrestrial ecology monitoring program.

- ESRP 3.6. Obtain a description of the nonradioactive waste systems in enough detail to support an analysis of the applicant's terrestrial ecology monitoring program.

- ESRP 3.7. Obtain a description of the power-transmission system in enough detail to support an analysis of the applicant's terrestrial ecology monitoring program.

- ESRP 4.3.1. Obtain a list of impacts from the site preparation and construction activities that should be evaluated by additional monitoring provisions.

- ESRP 5.3.3.2. Obtain evaluations of preoperational baseline monitoring program elements if there are predictions of any potential adverse impacts from heat dissipation.

- ESRP 5.4.4. Obtain information on radiological impacts to non-human biota regarding species receiving radiation doses in excess of 40 CFR 190 limits.

- ESRP 5.5.1. Obtain an evaluation of the impacts from discharge of nonradioactive effluents so that an evaluation of the monitoring programs for terrestrial ecology and land use can be completed.

- ESRP 5.6.1. Obtain information on any requirements for preoperational monitoring programs that are needed to establish a baseline for evaluating operational impacts from the transmission-line facilities.

- ESRP 6.7. Provide a list of potential additions or deletions to the applicant's proposed monitoring programs.

Data and Information Needs

The type of data and information needed will be affected by location and system-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a map showing features of the site and proposed and/or existing transmission and access corridors that will be modified by the proposed project, including major plant communities, important species and habitats, and existing or proposed sampling stations and monitoring locations (from the ER)

- a list and description of the "important" terrestrial ecological species and habitats that are likely to be affected by plant or transmission line construction or operation (from ESRP 2.4.1)

- a list of monitoring-program elements or parameters, including action or report levels for each element

- the type, frequency, and duration of observations or samples taken at each location, and appropriate rationale and sampling design (from the ER)

- the statistical validity of any existing or proposed sampling program. For quantitative descriptions of samples collected within each area of interest and each time of interest, descriptive statistics should include, unless justifiably omitted, the mean standard deviation, standard error, and confidence interval for the mean. In each case, the sample size should be clearly indicated. If diversity indices are used to describe a collection of terrestrial organisms, the specific diversity indices used should be stated. Also, describe the methods used for observing natural variations of ecological parameters. If these methods involve indicator organisms, the criteria for their selection should be stated. Statistical requirements for the monitoring program should be provided, using, as applicable, the Data Quality Objectives process (EPA 1994) (from the ER).

- sampling equipment used (from the ER)

- type of chemical analyses, if any, for soil and tissue samples (from the ER)

- data analysis and reporting procedures (from the ER)

- documentation of applicant consultations with the U.S. Fish and Wildlife Service, appropriate State agencies (e.g., fish and wildlife agency), and Native American tribal agencies (from the ER and from consultations with appropriate agencies)

- documentation of the environmental monitoring programs in policy directives designating a person or organizational unit responsible for reviewing the program on an ongoing basis. Procedures should establish criteria for

  - data recording and storage (from the ER)
  - reporting results to the NRC or consulting agency (from the ER)
  - actions to be taken for anomalous results or when results do not meet requirements.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of terrestrial environmental measurements and monitoring programs are based on the relevant requirements of the following:

- 10 CFR 51.50 with respect to conditions and monitoring requirements for protecting the non-aquatic environment related to the issuance of a construction permit, operating license, or combined license

- 10 CFR 51.71(c) with respect to the status of compliance with environmental requirements

- Coastal Zone Management Act of 1972 with respect to natural resources and land or water use of the coastal zone

- Endangered Species Act of 1973 with respect to identifying and monitoring endangered species

- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources in the planning of development projects that affect water resources

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), details the means by which the applicant should collect the baseline data presented in other sections and should describe the applicant's plans and programs for monitoring the environmental impacts of site preparation, station construction, and station operation. The reviewer should ensure that the applicant's plans for measurement of conditions before site preparation include all environmental parameters that must subsequently be monitored during station operation, as well as during site preparation and station construction.

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998), states that the ecological systems and biota at potential sites and their environs should be sufficiently well known to allow reasonably certain predictions that there would be no significant impacts to the terrestrial ecology associated with the construction or operation of a nuclear-power station at the site. The reviewer should ensure that the applicant's monitoring program is capable of identifying important species or ecological systems and detecting whether station construction and operation would have any deleterious impacts on these resources.

- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (NRC 1977), contains technical information for the design and execution of environmental monitoring studies, the results of which may be appropriate for inclusion in the applicant's environmental report. The reviewer should ensure that the appropriate results are included in the environmental report (ER).

- ANSI/ANS-18.5-1982 contains guidance and a rationale for performing terrestrial ecological monitoring at each stage of the licensing process and for specific power plant designs. The type, frequency, duration, and magnitude of impacts to terrestrial biota vary with power plant location, design, and methods of construction and operation. Thus, the reviewer should ensure that the applicant's proposed monitoring programs include study of those ecological variables that will most likely be impacted by the construction and operation of the individual power plant.

Technical Rationale

The technical rationale for evaluating the applicant's terrestrial ecology and land-use program is discussed in the following paragraph:

Monitoring programs written for individual power plant sites, designs, and ecological communities facilitate the identification of specific adverse impacts to terrestrial biota. Using a generic monitoring program could allow impacts to some species or their essential habitat to go undetected. Thus, it is important that the adequacy and accuracy of the data collection and analytical methods be examined for each specific site and that evaluations be made of supplemental programs needed to correct any foreseen inadequacies.

III. REVIEW PROCEDURES

The reviewer should consider the following general stages of the applicant's terrestrial ecology monitoring program:

Preapplication Monitoring

The program of terrestrial ecological field monitoring is used to support the applicant's descriptions of the terrestrial ecological environment. Preapplication monitoring is needed to support applications for early site permits, construction permits, operating licenses, and combined licenses.

Information from the applicant's preapplication monitoring program is used to aid in the assessment of site suitability and to support the staff's database as needed to identify and evaluate potential impacts to the terrestrial environment that could result from construction or operation of the proposed project. Generally, data are needed on a seasonal basis and should be sufficient to characterize seasonal variations throughout at least one annual cycle. Additional data may be needed on a site-specific basis.

(1) Evaluate the preapplication monitoring program to determine that it is adequate to support the environmental descriptions of ESRP 2.4.1. These data should cover the following:

- the distribution and abundance of "important" species and habitats. Critical life history information should include parameters such as feeding areas, wintering areas, and migration routes to the extent that the proposed project is expected to affect these parameters.

- descriptions of any modifications that may contribute to the existing patterns of plant and animal communities, including agricultural practices, the development of cooling ponds and reservoirs, cooling towers, transmission corridors, and access routes.

Except under unusual circumstances, no specific land-use monitoring will be required.

Site Preparation and Construction Monitoring

This monitoring is appropriate for applications for a construction permit or a combined license and is the proposed program of terrestrial environmental monitoring to control anticipated impacts from site preparation and facility construction. Construction monitoring will be required only when specific adverse impacts are predicted and when conscientious construction practices coupled with systematic inspection is insufficient to prevent adverse impacts.

(1) Determine predicted impacts from the ESRPs 4.1.1, 4.1.2, and 4.3.1.

(2) Analyze the proposed monitoring programs associated with these predicted impacts to determine if adequate impact assessment is possible and to determine that adequate mitigation programs can be selected if needed.

Preoperational Monitoring

A program of terrestrial environmental monitoring may be necessary to establish a baseline for identifying and assessing the environmental impacts to terrestrial biota resulting from plant operation. Preoperational monitoring programs should be evaluated for applications for an operating license or a combined license.

The applicant's preoperational monitoring plan should build on the preapplication monitoring program and the site preparation and construction monitoring. The program should be complementary, and if possible, integrated with environmental monitoring conducted in the vicinity of the power station by other agencies not supported by the applicant. The program should be statistically sound and designed to provide an adequate baseline so that the operational monitoring program can detect expected impacts with a degree of confidence commensurate with the risks and costs involved. Where consistent with construction planning, two or more consecutive years of data collection should be planned, and the program should demonstrate a logical extension of both the preapplication and site-preparation monitoring programs and should be integrated with any required construction monitoring programs.

(1) Analyze the program to determine if adequate baseline data will be provided to allow assessment of the following parameters:

- for closed-cycle cooling facilities, drift and vapor plume impacts regarding vegetation growth and habitat modification as it affects animals
- bird collisions with plant structures or transmission lines and towers
- any impacts on "important" species and habitats.

Operational Monitoring

A program of terrestrial ecological monitoring may be necessary to establish a baseline for use and evaluation of the environmental impacts of continued plant operation. It continues the studies conducted during preoperational monitoring. An operational monitoring program should be included with an application for an operating license, for a combined license, and for license renewal applications. Operational monitoring programs may not be fully developed at the time of applying for a construction permit.

General

When evaluating the above four types of monitoring programs, the following features should be considered:

(1) Ensure that the applicant has, to the extent feasible, described the general scope and objectives of its intended programs and has provided a tentative listing of parameters that it believes should be monitored. The application should include

- the duration over which the parameters will be monitored
- provisions for updating the program (included in the applicant's ER).

(2) Establish whether adequate data will be provided as outlined above. If the monitoring programs are judged to be inadequate or to include unnecessary elements, the reviewer should evaluate potential additions and deletions.

(3) Consider the following features for each of the four types of monitoring programs:

- The continuity of design, i.e., each monitoring program should build upon the methodology and informational outputs of the previous program.
- The relationship to environmental monitoring conducted by other agencies in the vicinity of the power station should be described.
- The bases and objective of each element of the monitoring program should be clearly stated, as well as its relationship to the overall environmental monitoring program.
- If outputs of a preceding monitoring program or project demonstrate no significant impacts, then provisions to study such effects in successive monitoring programs should be reduced or deleted.
- The program should allow for periodic modification based on the results of previous monitoring to ensure that the current monitoring effort is sufficient and justified when compared to a current assessment of the effects that plant construction and/or operation are having on the environment.

- The intensity of sampling required for each anticipated impact should be commensurate with the degree of impact expected. The reviewer should balance the potential impacts of any sampling program against the potential benefits when making this evaluation.

- Measurement and sampling methods, e.g., sampling locations and equipment, the pattern, frequency, and duration of sampling and sample size should be described.

- Statistical validity, including the mean, standard deviation, confidence limits, and sample size should be clearly indicated.

- If population-dynamics models were used in the impact analyses, determine if sampling data are available to support the model. If not, suggest such sampling if verification of the model is necessary.

IV. EVALUATION FINDINGS

The EIS should present the objectives of each monitoring program and provide a brief outline of the methods, frequency, and duration of sampling used in each case. If the monitoring programs have been found to be inadequate, the reviewer's evaluation of the potential modifications to the programs should be included.

If the reviewer verifies that sufficient information has been provided following the guidance of this ESRP, then the evaluation supports the following type of concluding statement, to be included in the staff's EIS:

> The staff reviewed the available information relative to the terrestrial ecological monitoring program and the data collected by the program. The staff concludes that the program provides adequate data to characterize and track impacts to the terrestrial ecological environment in support of the acceptance criteria outlined above.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.50, "Environmental report—construction permit stage."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 54.33, "Continuation of CLB and conditions of renewal license."

American National Standards Institute/American Nuclear Society (ANSI/ANS)-18.5-1982, "Surveys of Terrestrial Ecology Needed to License Thermal Power Plants."

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

U.S. Environmental Protection Agency (EPA). 1994. Guidance for the Data Quality Objectives Process. EPA QA/G-4, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Terrestrial Environmental Studies for Nuclear Power Stations*. Regulatory Guide 4.11, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2, Washington, D.C.

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6.5.2 AQUATIC ECOLOGY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and evaluation of the applicant's preapplication, site preparation and construction, preoperational, and operational monitoring programs in sufficient detail for making decisions on site acceptability and, ultimately, plant construction and operational procedures. Monitoring programs should cover elements of the ecosystem for which a causal relationship between station construction and/or operation and adverse change is established or strongly suspected. The scope of the review directed by this plan includes evaluations of standardization, adequacy and accuracy of data collection, and analytical methods used in the aquatic monitoring programs. If elements of the monitoring program are determined to be inadequate, staff evaluation of potential supplemental programs should be presented.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.3. Obtain appropriate information about the preexisting water-quality characteristics of the site and any expected changes to these characteristics that may result from power plant construction or operation.

- ESRP 2.4.2. Obtain appropriate information on the principal aquatic ecological features of the site and vicinity, including sanctuaries and preserves, natural areas and related areas, as well as important species and habitats (defined in ESRP 2.4.1).

- ESRP 3.4.1. Obtain a description of the cooling system and its operational modes that is detailed enough to support an analysis of the applicant's aquatic ecology monitoring program.

- ESRP 3.6. Obtain a description of the nonradioactive waste systems that is detailed enough to support an analysis of the applicant's aquatic ecology monitoring program.

- ESRP 3.7. Obtain a description of the power transmission system in enough detail to support an analysis of the applicant's aquatic-ecology monitoring program.

- ESRP 4.3.2. Obtain a list of any impacts from the construction activities that should be evaluated by additional monitoring provisions.

- ESRP 5.3.1.2. Obtain information on any preoperational baseline monitoring-program elements regarding predictions of any potential adverse impacts from operation of the cooling water intake system.

- ESRP 5.3.2.2. Obtain information on any preoperational baseline monitoring program elements regarding predictions of any potential adverse impacts from operation of the cooling water discharge system.

- ESRP 5.4.4. Obtain information on radiological impacts to non-human aquatic biota regarding species receiving doses in excess of 40 CFR 190 limits.

- ESRP 5.5.1. Obtain an evaluation of predicted impacts from discharge of nonradioactive effluents so that an evaluation of the adequacy of monitoring programs for aquatic ecology can be completed.

- ESRP 5.6.2. Obtain information on any requirements for preoperational monitoring programs that are needed to establish a baseline for evaluating operational impacts from the transmission line facilities.

- ESRP 6.7. Provide a list of potential additions or deletions to the applicant's proposed monitoring programs.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information will be needed:

- a map showing detailed features of the site (as modified by the proposed station), including major hydrological features and proposed or existing sampling-station and monitoring locations (from the environmental report [ER])

- a list and description of the "important" aquatic species and habitats that are likely to be affected by plant or transmission line construction, maintenance, or operation (from ESRP 2.4.2)

- a list of monitoring program elements or parameters, including action or report levels for each element

- the type, frequency, and duration of observations or samples taken at each laboratory, and appropriate rationale and sampling design (from the ER)

- the statistical validity of any existing or proposed sampling program. For quantitative descriptions of samples collected within each area of interest and each time of interest, descriptive statistics should include, unless justifiably omitted, the mean standard deviation, standard error, and confidence interval for the mean. In each case, the sample size should be clearly indicated. If diversity indices are used to describe a collection of aquatic organisms, the specific diversity indices used should be stated. Also, describe the methods used for observing natural variations of ecological parameters. If these methods involve indicator organisms, the criteria for their selection should be stated. Statistical and data quality requirements for the monitoring program should be provided, using, as applicable, the Data Quality Objectives process (EPA 1994) (from the ER).

- sampling equipment used (from the ER)

- sample-analysis procedures (from the ER)

- data analyses and reporting procedures (from the ER)

- the applicant's National Pollutant Elimination System (NPDES) permit, if available (from the ER)

- documentation of applicant consultations with the U.S. Fish and Wildlife Service, the EPA, or other appropriate Federal, State, regional, local (e.g., fish and wildlife agency), and affected Native American tribal agencies (from the ER and consultations with appropriate agencies)

- documentation of the environmental monitoring programs in policy directives designating a person or organizational unit responsible for reviewing the program on an ongoing basis. Procedures should establish criteria for

  - data recording and storage (from the ER)
  - reporting results to the NRC or consulting agency (from the ER)
  - actions to be taken for anomalous results or when results do not meet requirements.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of aquatic environmental measurements and monitoring programs are based on the relevant requirements of the following regulations:

- 10 CFR 51.50 with respect to conditions and monitoring requirements for protecting the environment related to the issuance of a construction permit, operating license, or combined license
- 10 CFR 51.71(c) with respect to the status of compliance with environmental requirements
- Coastal Zone Management Act of 1972 with respect to natural resources, and land or water use of the coastal zone
- Endangered Species Act of 1973 with respect to identifying and monitoring endangered species
- Federal Water Pollution Control Act Amendments of 1972 with respect to restoration and maintenance of the chemical, physical, and biological integrity of water resources
- Fish and Wildlife Coordination Act of 1958 with respect to consideration and monitoring of fish and wildlife resources and the planning of development projects that affect water resources
- Marine Mammal Protection Act of 1972 with respect to the protection of marine mammals
- Marine Protection, Research, and Sanctuaries Act of 1972 with respect to dumping of dredged material into the ocean and monitoring marine resources during construction

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), details the means by which the applicant collected the baseline data presented in other sections and should describe the applicant's plans and programs for monitoring the environmental impacts of site preparation, station construction, and station operation. The reviewer should ensure that the applicant's plans for measurement of conditions prior to site preparation include all environmental parameters that must subsequently be monitored during station operation, as well as during site preparation and station construction.
- Regulatory Guide 4.7, *General Site Suitability for Nuclear Power Stations* (NRC 1998), contains guidance that ecological systems and biota at potential sites and their environs be sufficiently well known to allow reasonably certain predictions that there would be no significant impacts to the aquatic ecology associated with the construction or operation of a nuclear power station at the site. The reviewer should ensure that the applicant's monitoring program is capable of identifying

important species or ecological systems and detecting whether station construction and operation have any deleterious impacts on these resources.

- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (NRC 1977), contains technical information for the design and execution of environmental monitoring studies, the results of which may be appropriate for inclusion in the applicant's ER. The reviewer should ensure that the appropriate results are included in the ER.

Technical Rationale

The technical rationale for evaluating the applicant's aquatic ecology program is discussed in the following paragraph:

> Monitoring programs written for individual power plant sites, designs, and ecological communities facilitate the identification of specific adverse impacts to aquatic biota. Using a generic monitoring program could allow some species or their essential habitat to go undetected. Thus, it is important that the adequacy and accuracy of the data collection and analytical methods be examined for each specific site and that evaluations be given of supplemental programs needed to correct any foreseen inadequacies.

III. REVIEW PROCEDURES

The program analysis involves the review of the following separate but related aspects of the applicant's aquatic-ecology monitoring program:

Preapplication Monitoring

The program of aquatic field monitoring is used to support the applicant's descriptions of the aquatic ecological environment. Preapplication monitoring is needed to support applications for early site permits, construction permits, operating licenses, and combined licenses.

The applicant's preapplication monitoring program is used to aid in the assessment of site suitability and to support the staff's database as needed to identify and evaluate potential impacts to the aquatic environment that would result from construction and operation of the proposed project. Generally, data are needed on a seasonal basis and should be sufficient to characterize seasonal variations throughout at least one annual cycle. Additional data (e.g., spawning periods for "important" species) may be needed on a site-specific basis.

- Evaluate the preapplication monitoring program to determine that it is adequate to support the environmental descriptions in ESRP 2.4.2. These data should cover the following:

- the distribution and abundance of "important" species and habitats. Critical life history information should include parameters such as spawning areas, nursery grounds, food habits, feeding areas wintering areas, and migration routes to the extent that the proposed project is expected to affect these parameters.

- descriptions of any modifications that may contribute to the existing patterns of plant and animal communities such as dams, dredging, clearing of stream banks, etc.

Site Preparation and Construction Monitoring

This monitoring is appropriate for applications for a construction permit or a combined license, and is the proposed program of aquatic environmental monitoring to control anticipated impacts from site preparation and plant construction. Construction monitoring will be required only when specific adverse impacts are predicted and when conscientious construction practices coupled with systematic inspection is insufficient.

When evaluating site preparation and construction monitoring,

- determine the predicted impacts from the output of the environmental reviews of ESRPs 4.2 and 4.3.2

- analyze the proposed monitoring programs associated with these predicted impacts to determine if adequate impact assessment is possible and that adequate mitigation programs can be selected if needed.

Preoperational Monitoring

A program of aquatic environmental monitoring may be necessary to establish a baseline for identifying and assessing the environmental impacts to aquatic biota resulting from plant operation. Preoperational monitoring programs should be evaluated for applications for an operating license or a combined license. Any necessary preoperational monitoring will ordinarily be defined in the NPDES permit.

When evaluating preoperational monitoring, analyze the available data to determine that they are adequate to support the environmental descriptions in ESRP 2.4.2, being sure to consider the following:

- the location and value of commercial and sport fisheries by species, season, and catch

- the distribution and abundance of "important" fish, shellfish, and other invertebrates including benthos. Critical life history information should include spawning areas, nursery grounds, feeding areas, wintering areas, and migration routes.

- endangered or threatened species that are known or expected to be present, together with any specific habitat requirements or community interrelationships

- the physical, chemical, and biological factors known to influence the distribution and relative abundance of "important" species

- station features and operations that contribute to the existing patterns of plant and animal communities, and that may increase the presence and abundance of nuisance organisms.

Operational Monitoring

A program of aquatic ecological monitoring may be necessary to establish a baseline for use and evaluation of the environmental impacts of continued plant operation. It continues the studies conducted during preoperational monitoring. Operational monitoring programs should be evaluated for applications for an operating license or a combined license. Any necessary operational monitoring program will be covered under the relevant NPDES permit.

General

When evaluating these four types of monitoring programs, the following features should be considered:

(1) Ensure that the applicant has, to the extent feasible, described the general scope and objectives of its intended programs and provided a tentative listing of parameters that it believes should be monitored.

   - The application should include the time period over which the parameters will be monitored.

   - Provisions for updating the program (included in the applicant's ER).

(2) Establish whether data will be provided as outlined above. Where the monitoring programs are judged to be inadequate or to include unnecessary elements, the reviewer should evaluate potential additions and deletions.

(3) Consider the following features for each of the four types of monitoring programs:

   - the continuity of design, i.e., each monitoring program builds upon the methodology and informational outputs of the previous program

   - the relationship to environmental monitoring conducted by other agencies in the vicinity of the power station

   - the bases and objective of each element of the monitoring program, as well as its relationship to the overall environmental monitoring program

- data from an earlier monitoring program or project. Where data demonstrate no significant impacts, then provisions to study such effects in successive monitoring programs should be reduced or deleted.

- The program should allow for periodic modification based on the results of previous monitoring to ensure that the current monitoring effort is sufficient and justified when compared with a current assessment of the effects that plant construction and/or operation are having on the environment.

- The intensity of sampling necessary for each anticipated impact should be commensurate with the degree of impact expected. The reviewer should balance the potential impacts of any sampling program against the potential benefits when making this evaluation.

- measurement and sampling methods, e.g., sampling locations and equipment; the pattern, frequency, and duration of sampling; and sample size to measure anticipated impacts

- statistical validity, including the mean, standard deviation, and confidence limits. Sample size should be clearly indicated.

- If population dynamics models are used in the impact analyses, determine if sampling data are available to support the model and, if they are not available, suggest such sampling if verification of the model is necessary.

IV. EVALUATION FINDINGS

This section of the EIS should present the objections of each monitoring program and provide a brief outline of the methods, frequency, and duration of sampling used in each case. Where the monitoring programs have been found to be inadequate, the reviewer's evaluation of modifications to the programs should be included.

If the reviewer verifies that sufficient information has been provided following the guidance of this ESRP section, then the evaluation supports the following type of concluding statement, to be included in the staff's EIS:

> The staff reviewed the available information relative to the aquatic ecological monitoring program and the data collected by the program. The staff concludes that the program provides adequate data to characterize and track impacts to the aquatic ecological environment in support of the acceptance criteria outlined above.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.50, "Environmental report–construction permit stage."

10 CFR 51.71, "Draft environmental impact statement–contents."

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Marine Mammal Protection Act, as amended, 16 USC 1361 et seq.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

U.S. Environmental Protection Agency (EPA). 1994. Guidance for the Data Quality Objectives Process. EPA QA/G-4, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1977. Terrestrial Environmental Studies for Nuclear Power Stations. Regulatory Guide 4.11, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2, Washington, D.C.

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6.6 CHEMICAL MONITORING

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of the applicant's construction, preoperational, and operational monitoring programs for water quality. The scope of the review directed by this plan includes analysis and evaluation of the adequacy and accuracy of the methodologies used for data collection, analysis, and interpretation of results for the water-quality monitoring programs.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.3.2. Obtain descriptions of the regional water uses (e.g., the location and nature of water users and water-use areas) for the area surrounding the proposed plant site.
- ESRP 2.3.3. Obtain descriptions of the baseline water quality of the water sources/bodies for the region surrounding the proposed plant site.
- ESRP 3.3. Obtain descriptions of the expected water use of the proposed plant.
- ESRP 3.6. Obtain descriptions of the nonradioactive waste systems for the proposed plant. Information regarding the quantity and concentration of waste streams (for chemicals or biocides, sanitary-system wastes, and other nonradioactive wastes) should be obtained.

- ESRPs 4.2.2 and 5.2.2. Obtain descriptions of recommended preoperational baseline chemical monitoring programs that were developed, based on analyses of the impacts of hydrological alterations, plant water supply, and water-use changes caused by plant construction or operation.

- ESRP 4.3. Obtain descriptions of recommended programs for monitoring the impacts of the proposed plant operations on ecosystems.

- ESRP 5.3. Obtain descriptions of any preoperational baseline chemical monitoring programs necessary to assess impacts of the intake and discharge system operation for the cooling system of the proposed plant.

- ESRP 5.5. Obtain impacts of the nonradioactive-waste systems (chemical and biocides, sanitary systems, other) for the proposed plant.

- ESRP 6.7. Provide a list of potential modifications to the applicant's proposed monitoring programs.

Data and Information Needs

The type of data and information needed will be specified by the National Pollutant Discharge Elimination System (NPDES) administrative agency. Site- and station-specific factors and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- systems to be sampled (from the environmental report [ER])

- location of sampling stations (from the ER)

- type of sample (e.g., surface grab or depth composite), number of replicates, and method of collecting the sample (from the ER)

- time of day, time period, and frequency of sampling (from the ER)

- methods of preserving the samples (from the ER)

- analytical methods used (from the ER)

- description of automated monitoring systems used (from the ER)

- reference or calibration standards used to verify accuracy of methods (from the ER)

- statistical methods used to interpret results (from the ER)

- quantitative data on chemical characteristics of surface-water and/or groundwater in the site and vicinity, including seasonal ranges and averages and historical extremes.

- data quality objectives (if available)

- quality assurance procedures.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of chemical monitoring programs are based on the relevant requirements of the following:

- 33 CFR 322 with respect to definition of activities requiring permits

- 33 CFR 330, Appendix A, with regard to conditions, limitations, and restrictions on construction activities

- 40 CFR 6, Appendix A, with regard to procedures on floodplain and wetlands protection

- 40 CFR 122 with respect to NPDES permit conditions for discharges including storm-water discharges

- 40 CFR 227 with respect to criteria for evaluating environmental impacts

- 40 CFR 149 with respect to possible supplemental restrictions on waste disposal and water use in or above a sole source aquifer

- 40 CFR 165 with respect to pesticide disposal

- 40 CFR 403 with respect to chemical effluents

- 40 CFR 423 with respect to effluent limitations on existing and new point sources

- Federal, State, regional, local, and affected Native American tribal water laws and water rights.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Compliance with environmental-quality standards and requirements of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action, including any degradation of water quality, and to consider alternatives to the proposed action, which are available for reducing the adverse impacts. If an environmental assessment of aquatic impacts is

available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority, the NRC (possibly in conjunction with the permitting authority and other agencies having relevant expertise) will establish its own impact determination.

- Since water quality and water supply are interdependent, changes in water quality must be considered simultaneously with changes in water supply. In Jefferson County PUD #1 vs. Department of Ecology (U.S. Supreme Court Case), the U.S. Supreme Court granted the States additional authority to limit hydrological alterations beyond the States' role in regulating water rights.

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the format and content of environmental reports, including hydrology, water-use, and water-quality issues.

Documentation of consultations with NPDES administrative agency is necessary to meet the objectives identified above.

Technical Rationale

The technical rationale for evaluating the applicant's chemical monitoring program is discussed in the following paragraphs:

A detailed and thorough description of the chemical monitoring is essential for the evaluation of potential impacts to the environment that may result from plant, construction or operation.

Adequate monitoring (baseline and operational) is generally a prerequisite for obtaining or renewing an NPDES permit.

III. REVIEW PROCEDURES

In this analysis, the reviewer should consider the following separate but related aspects of the applicant's water-quality monitoring program:

Preapplication Monitoring

The applicant's preapplication monitoring program aids in the assessment of site suitability and supports the staff's description of potential environmental impacts that would result from construction and operation of the proposed facility. Generally, data are needed on a seasonal basis, and descriptions should be sufficient to characterize seasonal variations throughout an annual cycle. The data provided should support the environmental descriptions of hydrology, water use, water quality, aquatic ecology, and plant water supply given in ESRP Chapters 2.0 and 3.0.

Construction Monitoring

A construction monitoring program may be required by the NPDES administrative agency to provide the data necessary to assess water-quality changes resulting from construction of the proposed project. The time frame for sampling each water-quality parameter should be appropriate for the period of expected change and should include preconstruction monitoring when it is necessary to establish a baseline.

Preoperational Monitoring

If preapplication monitoring data have not provided an adequate water-quality baseline, a preoperational monitoring program may be required by the NPDES administrative agency. Such a program should provide an adequate baseline so that the operational monitoring program can detect such changes with a degree of confidence commensurate with the risks and costs involved. When consistent with construction planning, two or more consecutive years of data collection should be planned, and the program should demonstrate a logical extension of both the preapplication and site preparation and construction monitoring programs.

The reviewer should analyze the ability of the proposed program to characterize the water quality at the site and in the vicinity and thus provide a baseline for the identification and measurement of water-quality changes from station operation.

Operational Monitoring

The applicant's operational monitoring program identifies changes in water quality resulting from plant operation. Operational monitoring programs update estimates of various effluent treatment systems' effectiveness and provide real time warnings of any failures in the effluent treatment systems. The reviewer should describe the operational monitoring system in terms of the NPDES permitting agency's monitoring requirements. The reviewer should also describe the status of NPDES permit consultations and NPDES permit renewal.

In evaluating these monitoring programs, the reviewer should take the following steps:

(1) Consider whether sufficient and adequate data to accomplish the goals of the monitoring programs will be provided.

   (a) If the monitoring programs are judged to be inadequate or to include unnecessary elements, consider modifications.

   (b) Ensure that all such recommendations are consistent with NRC policy and requirements established by the EPA or other State agencies responsible for the NPDES permit.

(2) Verify that the following features are described for each of the programs:

- Each monitoring program should build upon the methodology and data of the previous program.
- If data from an earlier monitoring program or project demonstrate no significant changes in a water-quality parameter, provisions to study such parameters in successive monitoring programs should be reduced or deleted.
- The intensity of sampling required for each water-quality parameter should be commensurate with the degree of impact expected.
- Sampling equipment, pattern, frequency, duration, and number of samples should be adequate to measure water-quality parameters.
- Statistical reliability, including the mean, standard deviation, and confidence limits, should be described.
- Data quality objectives, if any, should be described.
- Quality assurance procedures should be described.

IV. EVALUATION FINDINGS

The reviewer should verify that sufficient information has been provided by the applicant or obtained by the reviewer to meet the relevant requirements and that the evaluation supports the following type of statement to be included in the environmental impact statement (EIS):

> Based on the staff's independent evaluation of the applicant's description of the methodologies used for data collection, analysis, and interpretation of results, the staff concludes that the preapplication, site preparation and construction, and preoperational monitoring programs for water quality are valid and adequate to evaluate the impacts of the plant construction and operation on the water quality of the affected environment.

Input from ESRP 6.6 review to the EIS should briefly present the objectives of each monitoring program and provide an outline of the parameters, frequencies, locations, and duration of sampling. Tables and maps may be used if appropriate.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

33 CFR 322, "Permits for Structures and Work in or Affecting Navigable Waters of the United States."

33 CFR 330, Appendix A, "Nationwide Permit and Conditions."

40 CFR 6, Appendix A, "Statement of Procedures on Floodplain Management and Wetlands Protection."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination System."

40 CFR 149, "Sole Source Aquifers."

40 CFR 165, "Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticide Containers."

40 CFR 227, "Criteria for the Evaluation of Permit Applications for Ocean Dumping of Material."

40 CFR 403, "General Pretreatment Regulations for Existing and New Sources of Pollution."

40 CFR 423, "Steam Electric Power Generating Point Source Category."

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Jefferson County PUD #1 vs. Department of Ecology, 92-1911, Supreme Court of the United States, 510 U.S. 1037; 114 S. Ct. 677; 1994 U.S. LEXIS 795; 126 L. Ed. 2d 645; 62 U.S.L.W. 3450 (January 10, 1994).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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6.7 SUMMARY OF MONITORING PROGRAMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's summarization of applicant's environmental monitoring programs. As appropriate, the summary will cover (1) monitoring to be conducted during site preparation and project construction, (2) preoperational monitoring, and/or (3) operational monitoring. The scope of the review directed by this plan includes a summarization of the applicant's commitments for monitoring programs.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 4.1.1 and 4.1.2. Obtain information about any deficiency identified in the site preparation and construction monitoring program that should be corrected by additional monitoring provisions.
- ESRP 4.6. Provide a list of those monitoring programs that will permit application of adequate measures and controls to limit the adverse environmental impacts of site preparation and construction.
- ESRP 5.10. Provide a list of monitoring programs that will permit the application of adequate measures and controls to limit adverse environmental impacts of plant operation.

- ESRPs 6.1 through 6.6. Obtain input from the reviewers of other ESRPs related to monitoring (6.1 through 6.6) regarding the existing or proposed monitoring programs for each discipline.

- Project Manager's Handbook. Obtain the *Project Manager's Handbook*, NUREG/BR-0073, Rev. 1, to find information on applicant commitments and their applicability with and linkage to ESRP 6.7 (NRC 1989).

- Interface with the Environmental Project Manager. Provide a summary of the proposed environmental monitoring programs and any deficiencies identified in the plan that should be corrected by additional monitoring provisions.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to (1) the anticipated magnitude of the potential site preparation and construction impacts, (2) the need for adequate preoperational baseline environmental data, and (3) the types of environmental releases that may occur. The following data or information should be obtained:

- site preparation and construction monitoring (from the environmental report [ER])
- preoperational monitoring (from the ER)
- operational monitoring (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of efforts to limit adverse impacts during operation are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A, with respect to discussion of alternatives and mitigating measures to avoid or minimize adverse impacts.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance on the measures planned to reduce undesirable effects of station operation

- Regulatory Guide 4.8, Rev. 0, *Preparation of Environmental Technical Specifications for Nuclear Power Plants* (NRC 1975), contains guidance on the environmental-surveillance program.

- Regulatory Guide 4.15, Rev. 1, *Quality Assumptions for Radiological Monitoring Programs* (NRC 1979), contains guidance on quality of measurement results

Technical Rationale

The technical rationale for evaluating the applicant's monitoring programs is discussed in the following paragraph:

> Environmental monitoring is needed to establish baseline or reference environmental conditions preceding plant construction and operation to identify and evaluate potential changes to the environment during plant construction and operation, and to evaluate the effects of programs aimed at eliminating or mitigating adverse impacts during construction or operation.

III. REVIEW PROCEDURES

The reviewer's analysis should consist of identification and tabulation of the applicant's existing and proposed monitoring programs during site preparation and construction during the preoperational and operational stages, as appropriate.

When considering this analysis, the reviewer should use the following steps:

(1) Prepare a table listing the applicant's existing or proposed monitoring programs by general subject. Provide sufficient program details (e.g., instrumentation, location, sampling frequency) to allow adequate program description.

(2) Prepare a summary table describing the combined monitoring program suitable for inclusion in the environmental impact statement (EIS). Identify those program elements that have been defined in response to requirements of other agencies, e.g., NPDES permit conditions.

(3) If final program details for preoperational- and operational monitoring programs are not available at the time of the environmental review, tabulate the general program requirements and specify the date or time period when final program details should be available.

IV. EVALUATION FINDINGS

The reviewer for ESRP 6.7 should summarize the applicant's existing and proposed environmental monitoring programs, as appropriate for the site preparation and construction, preoperational, and operational stages. The summary should be provided in one or more EIS sections (as follows), depending on the nature of the application under consideration:

Site Preparation, Construction, and Refurbishment Monitoring

This section should describe the applicant's existing or proposed environmental monitoring program for site preparation and construction in tabular form. The table should describe the purposes and objectives of each program, provide sufficient program detail to establish the scope and content of the program and

to minimize the possibility of misinterpretation of a program or program element. For each monitoring program element, the table should also indicate whether the element exists or is a commitment of the applicant.

Preoperational Monitoring

This section should describe the applicant's existing or proposed preoperational environmental monitoring program. A tabular format should be used. Each program should be sufficiently specific to establish the scope and content of the program and to minimize the possibility of misinterpretation of a program or program element. When an element of a monitoring program has been described earlier and that element of the program will continue unchanged, a note referring to the previous description will be sufficient. When a previously described program element changes, the description should focus on the change. The input should specify the date or time period when these data should be made available for staff review, if complete preoperational program descriptions are not available.

Operational Monitoring

This section should describe the applicant's existing or proposed operational environmental monitoring program. Because this program may be proposed well before the initiation of operations and changes based on site-specific circumstances and because new regulations are likely to result in program changes, this program is understood to be preliminary. A tabular format should be used. Each program should be as specific as possible to establish the scope and content of the program and to minimize the possibility of misinterpretation of a program or program element. If an element of a monitoring program has been described earlier and that element of the program will continue unchanged, a note referring to the previous description will be sufficient. If a previously described program element changes, the description should focus on the change. The input should specify the date or time period when these data should be made available for staff review, if operational program descriptions are not available.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

U.S. Nuclear Regulatory Commission (NRC). 1975. *Preparation of Environmental Technical Specifications for Nuclear Power Plants.* Regulatory Guide 4.8, Rev. 0, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations.* Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1979. *Quality Assumptions for Radiological Monitoring Programs (Normal Operations)—Effluent Streams and the Environment.* Regulatory Guide 4.15, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1989. *Project Manager's Handbook*, NUREG/BR-0073, Rev. 1, Washington, D.C.

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7.0 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the environmental impacts of postulated accidents involving radioactive materials. The scope of the paragraph covered by this plan is to introduce the material from the reviews conducted under ESRPs 7.1 through 7.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluation of the applicant's data regarding environmental impacts of postulated accidents involving radioactive materials is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 7.1 through 7.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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7.1 DESIGN BASIS ACCIDENTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's evaluation and input to the environmental impact statement (EIS) of the environmental risks of accidents involving radioactive material that can be postulated for the plant under review.

The scope of this review is a comparison of the offsite dose consequences and resulting health effects for design basis accidents (DBAs) as calculated by the applicant and those contained in Section 15 of the safety evaluation report (SER).

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.7. Obtain the dispersion data for the site.
- SER Chapter 15. Obtain input from the responsible reviewer(s) of SAR Chapter 15 to ensure consistency of the review of DBAs and offsite releases.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained.

- the list of DBAs identified by the applicant as having a potential for releases to the environment and the applicant's analysis of the dose consequences from these accidents (from the ER or from the reviewer of SAR Chapter 15 as appropriate)

- the list of DBAs considered in the staff's safety evaluation and the analysis of the magnitude of the source-term for offsite releases (from Chapter 15 of the safety evaluation or from the reviewer for SAR Chapter 15)

- the 50th percentile normalized concentrations (χ/Q) at appropriate distances from the effluent release points (from ESRP 2.7).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of environmental impacts of postulated accidents involving radioactive material and related to the plant are based on the relevant requirements of the following:

- 10 CFR 50.34 with respect to the applications for construction permits and operating licenses. This includes an analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility.

- 10 CFR 52.17 with respect to applications for early site permits

- 10 CFR 52.79 for combined licenses with regard to requirements in 10 CFR 50.34 for the analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 1.3, Rev. 2, *Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors* (NRC 1974), with respect to evaluating the potential radiological consequences of a loss-of-coolant accident for boiling-water reactors (BWRs)

- Regulatory Guide 1.4, Rev. 1, *Assumptions used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors* (NRC 1973), with respect to evaluating the potential radiological consequences of a loss-of-coolant accident for pressurized-water-reactors (PWRs)

- Regulatory Guide 1.70, Rev. 3, *Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants - LWR Edition* (NRC 1978) with respect to analyses of DBAs other than loss-of-coolant accidents

- Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants* (NRC 1982) with respect to information on dispersion models

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976) with respect to the calculation of χ/Q values for determining offsite dose consequences from postulated accidents.

Technical Rationale

The technical rationale for evaluation of the applicant's plant accident data is discussed in the following paragraphs:

Applicants for construction permits, operating licenses, combined licenses and early site permits are required to evaluate the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from the operation of the facility. For construction-permit applications, this information is to be contained in a preliminary safety analysis report (PSAR). Applicants for operating licenses and combined licenses are required to prepare a final safety analysis report (FSAR).

Events up through Class 8 accidents were previously the only accidents considered in SARs and staff SERs. They were and are currently used, together with conservative assumptions, as the design basis events to establish the performance requirements of engineered safety features.

Guidance on reviewing safety analysis report submittals related to postulated accidents is in Chapter 15 of NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 1985). The SRP Chapter 15 contains the methodology for reviewing the models, assumptions, and parameter values used to determine the offsite releases from DBAs. However, the conservative assumptions and calculations used in NRC safety evaluations substantially overestimate the environmental risk. Among the conservative assumptions used pursuant to the Chapter 15 analyses is the use of adverse meteorological dispersion conditions (i.e., 95th percentile χ/Q). Actual consequences will likely be far less severe than those given for the same events in SARs where more conservative evaluations are used. For this reason, DBAs (up through Class 8) are evaluated using more realistic meteorological conditions. Consequences

predicted in this way will be far less severe than those given for the same events in SARs where more conservative estimates of meteorology are used.

III. REVIEW PROCEDURES

Accidents are categorized as "design basis" or "severe." The DBAs are accidents that the plant is designed specifically to accommodate. The evaluation of DBAs is performed for the NRC's SER using conservative assumptions.

This ESRP section is designed to evaluate the applicant's assessment of the environmental consequences of DBAs.

The analysis procedures are given for DBAs only.

Design-Basis Accidents

When analyzing doses calculated to result from DBAs, the reviewer should do the following:

(1) Examine the applicant's descriptions of accidents considered (as given in the ER) and compare them with the descriptions of accidents given in Appendix A of this ESRP (as taken from Chapter 15 of the SRP) to ensure that all accidents with anticipated offsite-dose consequences have been considered.

   (a) Coordinate with the reviewer of SRP Chapter 15 to ensure that all appropriate accidents have been identified.

   (b) Verify that the applicant provides a justification (included in the EIS) for not estimating the consequences of any accident given in Appendix A to this ESRP.

(2) Examine the applicant's estimated doses for the appropriate accidents given in Chapter 15 of the SRP. Ensure that the applicant used a 50th percentile χ/Q value that was based on onsite meteorological data, or 10% of the levels given in Regulatory Guide 1.3 or Regulatory Guide 1.4, to represent more realistic dispersion conditions than assumed in the safety evaluation.

(3) Determine that the calculation of dose consequences resulting from a DBA to verify that the applicant's proposed exclusion area and low-population-zone distances are adequate to provide a high degree of protection of the public from a variety of potential plant accidents.

   For construction permit holders before January 10, 1997, a low population zone should be of such a size that an individual located at any point on its outer boundary who is exposed to the radioactive cloud resulting from the release during the entire period of the passage would not receive a total radiation dose to the whole-body in excess of 0.25 sievert (25 rem) or a total radiation dose in excess of 3 sieverts (300 rem) to the thyroid from exposure to iodine (10 CFR 100.11). For all other

applicants, the current siting regulations require an exclusion area of such a size that an individual located for any 2-hour period at the exclusion area boundary would receive a dose that would not be in excess of 0.25 sievert (25 rem) total effective dose equivalent (TEDE). A license to operate the facility would not be granted if the calculated exposures exceed the dose-guideline values.

IV. EVALUATION FINDINGS

The depth and extent of input to the EIS will be governed by the nature of the plant accidents and their impacts on the proposed project. The following information should be included:

- a general discussion of DBAs and the methodology used to calculate realistic dose consequences
- the staff's findings, relative to this plant, including
  - the radionuclide inventory of the reactor core at full power
  - the estimates of the 2-hour dose consequences at the proposed exclusion area boundary and the 30-day consequences in the low-population zone
  - a comparison of the offsite-dose consequences and health effects estimated by the applicant with those determined for normal and anticipated releases (as obtained from ESRP 5.4.3)
- a conclusion about the degree of environmental impact due to postulated DBAs at this plant. The reviewer should use language similar to that from the preamble to the current 10 CFR 100 that states, if appropriate,

  > The Commission's use of the value (of 0.25 sievert [25 rem] TEDE) does not imply that it considers it to be an acceptable limit for an emergency dose to the public under accident conditions, but only that it represents a reference value to be used for evaluating plant features and site characteristics intended to mitigate the radiological consequences of accidents in order to provide assurance of low risk to the public under postulated accidents. The Commission, based upon extensive experience in applying this criterion, and in recognition of the conservatism of the assumptions in its application (a large fission product release within containment associated with major core damage, maximum allowable containment leak rate, a postulated single failure of any of the fission product cleanup systems, such as the containment sprays, adverse site meteorological dispersion characteristics, an individual presumed to be located at the boundary of the exclusion area at the centerline of the plume for two hours without protective actions), believes that this criterion has clearly resulted in an adequate level of protection.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 50.34, "Contents of application; technical information."

10 CFR 50.17, "Contents of application."

10 CFR 52.79, "Contents of applications; technical information."

10 CFR 100, "Reactor Site Criteria."

10 CFR 100.11, "Determination of exclusion area, low population zone, and population center distance."

U.S. Nuclear Regulatory Commission (NRC). 1973. *Assumptions used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors*. Regulatory Guide 1.4, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1974. *Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors*. Regulatory Guide 1.3, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1978. *Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants - LWR Edition*. Regulatory Guide 1.70, Rev. 3, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1982. *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*. Regulatory Guide 1.145, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1985. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, Section 2.3.3. Appendix A, Recommended Format for Hourly Meteorological Data to be Placed on Magnetic Tape*. NUREG-0800, Washington, D.C.

APPENDIX A

DESIGN BASIS ACCIDENTS INCLUDED IN SECTION 15 OF THE STANDARD REVIEW PLAN

SRP Section	Design-Basis Accident Description
15.1.5A	Radiological Consequences of Main Steam Line Failures Outside Containment of a PWR
15.2.8	Feedwater System Pipe Breaks Inside and Outside Containment (PWR)
15.3.3	Reactor Coolant Pump Rotor Seizure
15.3.4	Reactor Coolant Pump Shaft Break
15.4.9A	Radiological Consequences of Control Rod Drop Accident (BWR)
15.6.2	Radiological Consequences of the Failure of Small Lines Carrying Primary Coolant Outside Containment
15.6.3	Radiological Consequences of Steam Generator Tube Failure (PWR)
15.6.5A	Radiological Consequences of a Design Basis Loss of Coolant Accident Including Containment Leakage Contribution
15.6.5B	Radiological Consequences of a Design Basis Loss of Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment
15.6.5D	Radiological Consequences of a Design Basis Loss of Coolant Accident: Leakage From Main Steam Isolation Valve Leakage Control System (BWR)
15.7.4	Radiological Consequences of Fuel Handling Accidents

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7.2 SEVERE ACCIDENTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's evaluation and input to the environmental impact statement (EIS) of the environmental risks of accidents involving radioactive material that can be postulated for the plant under review.

The scope of this review should include dose consequence analysis for severe accidents, including the socioeconomic impacts and, where applicable, the impact to biota. This includes coordination with the reviewers of safety analysis report (SAR) Chapter 19, 10 CFR 50.34(f), the reviewers of the individual plant examination (IPE), and the individual plant examination of external events (IPEEE). The review directed by this plan includes consideration of a limited amount of plant specific data in sufficient detail to appropriately evaluate the dose consequences for severe accidents.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.4.1 and 2.4.2. Obtain a list of threatened and endangered species and critical habitats.
- ESRP 2.5.1. Obtain the estimated population data and distribution within an 80-km (50-mile) radius for a date 5 years from the time of the licensing action under consideration.
- ESRP 5.4.1. Obtain information regarding the anticipated exposure pathways.

- ESRP 5.4.3. Obtain the dose consequences and health effects associated with normal operational releases.

- ESRP 5.8.3. Provide regions of impacts from the postulated accidents.

- ESRP 7.3. Provide a list of the dominant severe-accident sequences and dose consequences, including the initiating-event contribution to population dose and accident progression bin contribution to population dose.

In addition, the reviewer of severe accidents should obtain input from reviewers of information covered in the following documents:

- SER Chapter 19. Coordinate with the responsible reviewer(s) (or review branch) of SAR Chapter 19 to ensure consistency with the severe-accident analyses given by the applicant in the environmental report (ER).

- Individual Plant Examination. Coordinate with the responsible reviewer(s) or review branch for the IPE to ensure consistency with the severe-accident analysis given by the applicant in the ER (NRC 1988).

- Individual Plant Examination for External Events. Coordinate with the responsible reviewer of the IPEEE to ensure consistency with the severe-accident analyses given by the applicant in the ER (NRC 1991).

- 10 CFR 50.34(f). Coordinate with the responsible reviewer of 10 CFR 50.34(f) to ensure consistency with the severe-accident analyses given by the applicant in the ER.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained.

- a list of leading contributors to (1) core-damage frequency (e.g., from dominant severe-accident sequences or initiating events), (2) large-release frequency (e.g., from each containment failure mode or accident-progression bin), and (3) dose consequences with and without interdiction (e.g., from each release class and associated source term) (from the ER)

- the projected demographic data within an 80-km (50-mile) radius from the plant for the 5 years from the time of the licensing action under consideration (from ESRP 2.5.1)

- meteorological data for a 1-year period represents current conditions (from ESRP 2.7)

- socioeconomic impacts that might be associated with emergency measures during or following an accident (from the ER)

- radiological dose consequences and health effects associated with normal and anticipated operational releases (from ESRP 5.4.3).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of environmental impacts of postulated accidents involving radioactive material and related to the plant are based on the relevant requirements of the following:

- 10 CFR 52.17 with respect to applications for early site permits

- 10 CFR 52.79 for combined licenses with regard to requirements in 10 CFR 50.34 for the analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility.

Technical Rationale

The technical rationale for evaluation of the applicant's plant accident data is discussed in the following paragraph:

> The Commission decided that the events or accident sequences that lead to releases shall include, but not be limited to, those that can reasonably be expected to occur. The environmental consequences of releases whose probability of occurrence has been estimated shall also be discussed in probability terms. Although the consequences of the accidents that can reasonably be expected to occur are expressed in terms of potential exposure to individuals, the consequences of severe accidents (referred to as probabilistic accidents in the policy statement) are characterized in terms of exposure to population groups and, where applicable, to the biota. Releases refer to radiation and/or radioactive materials or both entering environmental exposure pathways, including air, water, and groundwater. In-plant accident sequences that can lead to a spectrum of releases shall be discussed and shall include sequences that can result in inadequate cooling of reactor fuel and melting of the reactor core. The events arising from causes external to the plant that are considered possible contributors to the risk associated with the plant should be discussed. Socioeconomic impacts associated with emergency measures during or following an accident should also be discussed, and the environmental risks compared to and contrasted with radiological risks should be associated with normal and anticipated operational releases. The Commission also took the position that detailed quantitative considerations that form the basis of probabilistic estimates of releases do not need to be incorporated into the EIS, but shall be referenced, including references to safety evaluation reports.

III. REVIEW PROCEDURES

Severe accidents are those involving multiple failures of equipment or function and, therefore, the likelihood of occurrence is lower for severe accidents than for DBAs, but the consequences of such accidents may be higher. The environmental consequences of severe accidents are estimated using acceptable methodology (such as the MACCS code package; Chanin et al. [1990]). The risks for specific accident types are defined as the product of the probability of that type of accident occurring multiplied by the estimated consequences for that type of accident.

This ESRP section is designed to provide a methodology for reviewing the applicant's probabilistic assessment of the dose consequences of severe accidents.

When analyzing doses calculated to result from severe accidents, the reviewer should do the following:

(1) Consult the reviewer (or review branch) for the IPE, the reviewer of Chapter 19 of the SAR, or the reviewer of 50.34(f) to determine if the information given in the ER on which the applicant's analysis is based is appropriate; that is, whether the applicant properly assessed and depicted severe-accident sequences, core damage, severe-accident progression, containment response, release categories, and source terms.

   (a) In consultation with the reviewer of the IPE, Chapter 19 of the SAR or the reviewer of 10 CFR 50.34(f), determine whether an acceptable platform has been provided for assessing the environmental consequences of severe accidents.

   (b) Consider the IPEEE for the analysis of severe accidents resulting from external initiators and the corresponding source-term releases.

(2) Consult with the reviewer for ESRP 2.5.1 and review other appropriate sources of demographic data to ascertain that sufficient population data were used for the applicant's calculation of the population dose and that an appropriate population distribution was used.

(3) Ensure that the dispersion data were determined from representative onsite meteorological data by coordinating your review with the reviewer of ESRP 2.7.

(4) Ensure that estimates of the collective dose were made for the projected population within an 80-km (50-mile) radius.

(5) Determine if the applicant appropriately extended the information on anticipated release classes and containment response to the calculation of dose consequences.

   (a) Evaluate the dose-consequence code to determine if the consequence code used by the applicant is currently supported by NRC for estimating the dose consequences associated with severe reactor accidents.

(b) If the applicant used a code not currently endorsed by the NRC, either evaluate the code that was used or determine the dose consequences resulting from selected severe accidents using an NRC-endorsed code to compare with the dose consequences calculated by the applicant.

(6) Evaluate the protective actions that the applicant considered in its evaluation of the dose consequences from severe accidents to determine if the protective actions were appropriately considered.

(7) Evaluate the applicant's analysis of the groundwater pathway for radiation exposure to the public.

(a) Refer to the analysis of the potential consequences of a liquid-pathway release for generic sites as presented in NUREG-0440 (NRC 1978).

(b) Ensure that the generic analysis is bounding for this particular plant.

(8) Review the socioeconomic impacts that might be associated with emergency measures during or following an accident. This would include a review of the probability distribution for cost of offsite mitigating actions including the following:

- evacuation costs
- value of crops contaminated and condemned
- value of milk contaminated and condemned
- costs of decontamination of property (where practical)
- indirect costs resulting from the loss of use of property and incomes derived as a result of the accident (this would include any interdiction to prevent the use of property until it is either free of contamination or can be economically decontaminated).

(9) Review the applicant's characterization of environmental consequences to biota.

(a) Determine the presence of threatened and endangered species and federally designated critical habitat by coordinating with the reviewers of ESRPs 2.4.1 and 2.4.2.

(b) Determine if the previously calculated radiation-exposure levels would significantly impact the threatened and endangered species located in the area or in any nearby critical habitats.

(c) Obtain assistance in making this evaluation from the reviewer for ESRP 5.4.4, as needed.

(10) Compare the offsite-dose consequences and health effects estimated by the applicant with those determined for normal and anticipated releases. In doing this, do not forget that the offsite-dose consequences from severe accidents are expressed probabilistically.

IV. EVALUATION FINDINGS

The depth and extent of input to the EIS will be governed by the nature of the plant accidents and their impacts on the proposed project. The following information should be included:

- a summary of atmospheric releases in severe-accident sequences (this includes the accident sequence or sequence group, the probability of the accident sequence per reactor year, and the fraction of the core inventory released)

- a summary of the environmental impacts and probabilities of severe accidents (including the probability of impact per reactor-year, the number of persons exposed to doses greater than 2 sieverts (200 rem) and greater than 0.25 sievert (25 rem), the population exposure, the number of latent cancers, and the cost of offsite mitigating actions)

- a summary of early fatalities and probabilities (including the probability of impact per reactor-year)

- the average values of environmental risks resulting from accidents per reactor-year (see NUREG-0921 [NRC 1983], Tables 5.8 through 5.13 for examples).

- a comparison of the environmental risk of severe accidents with (and contrasted to) the radiological risks associated with normal and anticipated operational releases. If appropriate, the following concluding statement may be used

  > The environmental impacts that have been considered include potential radiation exposures to individuals and to the population as a whole, the risk of near- and long-term adverse health effects that such exposures could entail, and the potential economic and societal consequences of accidental contamination of the environment. These impacts could be severe, but the likelihood of their occurrence is judged to be small. This conclusion is based on (1) considerable experience gained with the operation of similar facilities without significant degradation of the environment, (2) to obtain a license, the applicant must comply with the applicable Commission regulations and requirements, and (3) a previously analyzed assessment of the risk of design-basis and severe accidents. The overall assessment of environmental risk of accidents, assuming protective action, shows that it is roughly comparable with the risk from normal operation, although accidents have a potential for early fatalities and economic costs that cannot arise from normal operations. The risks of an early fatality from potential accidents at the site are small in comparison with the risks of an early fatality from other human activities in a comparably sized population.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 50.34, "Contents of application; technical information."

10 CFR 52.17, "Contents of application."

10 CFR 52.79, "Contents of applications; technical information."

Chanin, D. I., J. L. Sprung, and L. T. Ritchie. 1990. *MELCOR Accident Consequence Code System (MACCS). Volume 1: User's Guide.* NUREG/CR-4691 Volume 1. Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Nuclear Regulatory Commission (NRC). 1978. *Liquid Pathway Generic Study: Impacts of Accidental Radioactive Releases to the Hydrosphere from Floating and Land-Based Nuclear Power Plants.* NUREG-0440, Washington D.C.

U.S. Nuclear Regulatory Commission (NRC). 1983. *Final Environmental Statement Related to the Operation of Catawba Nuclear Station, Units 1 and 2.* NUREG-0921, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1988. Generic Letter 88-02 - Individual Plant Examination for Severe Accident Vulnerabilities. November 23, 1988, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1991. Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10 CFR 50.54(f)," Washington, D.C.

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7.3 SEVERE ACCIDENT MITIGATION ALTERNATIVES

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's evaluation of the severe accident mitigation alternatives (SAMAs), referred to as severe accident mitigation design alternatives (SAMDAs) in some references. The scope includes the identification and evaluation of design alternatives and procedural modifications that reduce the radiological risk from a severe accident by preventing substantial core damage (i.e., preventing a severe accident) or by limiting releases from containment in the event that substantial core damage occurs (i.e., mitigating the impacts of a severe accident). The intent is to identify additional cases that might warrant either additional features or other actions that would prevent or mitigate the consequences of serious accidents.

Review Interfaces

The reviewer for this ESRP should provide input to or obtain input from the reviewers for the following ESRP sources, as indicated:

- ESRP 7.2. Obtain information that characterizes the risk profile of the plant. This includes a list showing leading contributors to (1) core damage frequency (e.g., from dominant severe accident sequences or initiating events), (2) large release frequency (e.g., from containment failure mode or accident-progression bin), and (3) dose consequences with and without interdiction (e.g., from each release class and associated source term).

- 10 CFR 50.34(f)(1)(I). Obtain input from the responsible 10 CFR 50.34(f)(1)(I) reviewer to ensure consistency of the SAMA and the 10 CFR 50.34(f)(I)(I) reviews.

- Internal Plant Examination (IPE). Obtain input from the responsible reviewer for the IPE to ensure consistency of the SAMA analysis with the findings of the IPE.

- Internal Plant Examination of External Events (IPEEE). Obtain input from the responsible reviewer of the IPEEE to ensure consistency of the SAMA analysis with the results of the IPEEE.

- Safety Analysis Report (SAR), Chapter 19 Review. Obtain input from the responsible reviewer of Chapter 19 of the SAR to assure consistency of the SAMA analysis with the results of the SAR Chapter 19 review.

Data and Information Needs

The type of data and information needed will be affected by site- and station-station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a list of leading contributors to (1) core damage frequency (e.g., from dominant severe accident sequences or initiating events), (2) large release frequency (e.g., from containment failure mode or accident progression bin), and (3) dose consequences with and without interdiction (e.g., from each release class and associated source term) (from ESRP 7.1)

- the methodology, process, and rationale used by the applicant to identify, screen, and select design alternatives and procedural modifications (from the environmental report [ER])

- the estimated cost, risk reduction, and value impact ratios for the selected SAMAs and the assumptions used to make these estimates (from the ER)

- a description and list of any alternatives that have been or will be implemented to prevent or mitigate severe accidents or reduce the risk of a severe accident (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the analysis and evaluation of severe accident mitigation alternatives are based on the relevant requirements of the following:

- the U.S. Court of Appeals decision in Limerick Ecology Action v. NRC 869 F.2d 719 (3rd Cir. 1989) with respect to the requirement that the NRC include consideration of certain SAMAs in environmental impact reviews performed under Section 102(2)(c) of NEPA as part of operating-license applications

- 10 CFR 50.34(f)(1)(I) with respect to requirements for the applicant to perform a plant/site-specific probabilistic risk assessment, the aim of which is to seek such improvements in the reliability of core and containment heat removal systems that are significant and practical and do not impact excessively on the plant

- 10 CFR 52.17 with respect to requirements in 10 CFR 50.34(f) for the applicant to perform a plant/site-specific probabilistic risk assessment, the aim of which is to seek such improvements in the reliability of core and containment heat removal systems that are significant and practical and do not impact excessively on the plant

- 10 CFR 52.79 with respect to requirements to contain the technically relevant information required of applicants for an operating license in 10 CFR 50.34

Regulatory positions and specific criteria necessary to meet the regulations identified above are provided in the following:

- Interim Policy Statement, "Power Plants—Nuclear Power Plant Accident Considerations under NEPA" (1980) with respect to the early consideration of either additional features or other actions that would prevent or mitigate the consequences of serious accidents

- SECY-91-229 (NRC 1991a), which presents alternative courses of action and the staff's recommendations concerning the treatment of the SAMA issues to be considered under NEPA as they relate to the certification of standard plant designs, including evolutionary, passive, and advanced reactors

- NUREG/BR-0058, Rev. 2 (NRC 1997a), which states the policy for the preparation and the contents of regulatory analyses, including estimation of values and impacts for design alternatives and the "dollars per person-rem" conversion factors

- NUREG/BR-0184 (NRC 1997b) with respect to the value impact methodology

- NUREG/CR-6349 (Mubayi et al. 1995) with respect to dollars per person-rem conversion factor for offsite damage costs

- Generic Letter 88-20 (NRC 1988) with respect to the performance of an IPE at operating plants for severe-accident vulnerabilities

- Generic Letter 88-20, Supplement 3 (NRC 1990), with respect to accident prevention and mitigation features identified in the Containment Performance Improvement Program that may be valid for consideration in the review of SAMA

- Generic Letter 88-20, Supplement 4 (NRC 1991b), with respect to conducting an individual plant examination for externally initiated events.

In addition, the following acceptance criterion is used:

- Completeness and reasonableness, also with respect to the following: (1) the identification of SAMAs applicable to the plant or design under consideration, (2) the estimation of core damage frequency reduction and averted person-rem for each SAMA, (3) the estimation of cost for each SAMA, (4) the ranking of value-impact screening criteria to identify SAMAs for further consideration, and (5) the final disposition of promising SAMAs.

Technical Rationale

The technical rationale for evaluation of the applicant's severe accident mitigation alternatives is discussed in the following paragraphs:

An evaluation of SAMAs is required to be performed as part of the certification of new designs for nuclear power plants (as well as licensing custom plants) and for site approval applications. The purpose of SAMAs is to review and evaluate plant-design alternatives that could significantly reduce the radiological risk from a severe accident by preventing substantial core damage (i.e., preventing a severe accident) or by limiting releases from containment in the event that substantial core damage occurs (i.e., mitigating the impacts of a severe accident).

In 1980, the NRC published an interim policy statement (Interim Policy Statement, "Nuclear Power Plant Accident Considerations Under the National Environmental Policy Act of 1969" [NRC 1980]) that stated that it was the intent of the Commission for the staff to take steps to identify additional cases that might warrant early consideration of either additional features or other actions that would prevent or mitigate the consequences of serious accidents.

In 1985, the NRC published a policy statement ("Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants," August 9, 1985 [NRC 1985a]). It concluded that existing plants posed no undue risk to public health and safety and no present basis for immediate action on a generic rulemaking or other regulatory changes for these plants because of severe accident risk. However, the policy statement indicated that "the Commission plans to formulate an approach for a systematic safety examination of existing plants to determine whether particular accident vulnerabilities are present and what cost-effective changes are desirable to ensure that there is no undue risk to public health and safety."

A 1989 court decision (*Limerick Ecology Action vs. NRC*, 869 F.2d 719 [3rd Cir. 1989] stated that the "Action of NRC in addressing severe accident mitigation design alternatives through policy statement, not rule making, did not satisfy NEPA, where policy statement did not represent requisite careful consideration of environmental consequences, excluded consideration of design alternatives without making any conclusions about effectiveness of any particular alternative, and issues were not generic in that impact of severe accident mitigation design alternatives on environment would differ with particular plant's design, construction and locations."

Currently, NRC considers the evaluation of SAMAs in the environmental impact review that is now performed as part of every application for a construction permit, an early site permit, an operating license, and a combined license. In addition, the Commission has endorsed staff consideration of SAMAs in conjunction with the design certification application. The purpose of this consideration is to ensure that plant design changes with the potential for improving severe accident performance are identified and evaluated.

III. REVIEW PROCEDURES

This procedure applies to the review of applications for construction permits, operating licenses, combined licenses, standard design certifications, and early site permits.

When evaluating SAMAs, the reviewer should do the following:

(1) Be familiar with analyses previously performed and with the potential process and design alternatives, if any, in previous studies, including the following:

- Limerick (NRC 1989)
- Watts Bar (NRC 1995)
- 10 CFR 50.34(f)(l)(I) reviews of the System 80+ (NRC 1997c)
- the Advanced Boiling Water Reactor (ABWR) (NRC 1997d)
- the GESSAR II (NRC 1985b)
- the Containment Improvement Program
- Generic Environmental Impact Statement for License Renewal (NRC 1996).

(2) Evaluate the applicant's methods for identifying the potential mitigation alternatives. If the applicant used an alternative methodology to a probabilistic risk assessment approach to assess potential SAMAs (e.g., a margins-based approach to evaluate external events initiated by fires or seismic activity), the staff evaluation should be appropriately modified. For example, the synergistic effects of mitigation alternatives that reduce risks for internally initiated events that also provide a benefit for mitigation of externally initiated events should be considered. Alternative benefit-cost approaches are appropriate when a margins method has been used to screen external events.

(a) Determine if this set of potential design alternatives and procedural modifications represents a reasonable range of preventive and mitigative alternatives.

(b) Verify that the applicant's list of potential SAMAs includes a reasonable range of applicable SAMAs derived from consideration of previous analyses and based on insights from the Level 1 and Level 2 portions of the applicant's probabilistic risk assessment (PRA) or IPE/IPEEE.

(3) Evaluate the applicant's basis for estimating the degree to which various alternatives would reduce risk (expressed as a reduction in core damage frequency or in terms of person-rem averted). In performing its independent assessment, the staff may make bounding assumptions to determine the magnitude of the potential risk reduction for each SAMA.

(4) Evaluate whether the applicant's cost estimates for each SAMA are reasonable and compare the cost estimates with estimates developed elsewhere (e.g., using previous SAMA evaluations or using accepted cost-estimation tools).

(5) Evaluate the benefit-cost comparison to determine if it is consistent with the benefit-cost balance criteria and methodology given in NUREG/BR-0058, Rev. 2 (NRC 1997a), and further analyze any SAMAs that are within a decade of the NUREG/BR-0058, Rev. 2, or NUREG/CR-6349 (Mubayi et al. 1995) benefit-cost criteria to ensure that a sufficient margin is present to account for uncertainties in assumptions used to determine the cost and benefit estimates. The benefit-cost criterion in NUREG/BR-0058 is $200,000 per person-sievert averted ($2000 per person-rem averted) for health effects. In addition, a criterion of $300,000 per person-sievert averted ($3000 per person-rem averted) is given in NUREG/CR-6349 (Mubayi et al. 1995) for offsite damage and other related costs for severe accidents.

(6) Subject any SAMAs that remain following the screening given above to further probabilistic and deterministic considerations, including a qualitative assessment of the following:

- the impact of additional benefits that could accrue for the SAMA if it would be effective in reducing risk from certain external events, as well as internal events
- the effects of improvements already made at the plant
- any operational disadvantage associated with the potential SAMA.

IV. EVALUATION FINDINGS

The input to the environmental impact statement (EIS) should describe the applicant's analysis and detail the staff's review process. Any design mitigation or procedural modification should be described along with the estimated benefit-cost ratio. The risk reduction for the facility should be provided.

A concluding statement similar to the following should be made in the EIS:

> The staff concludes that the applicant completed a comprehensive, systematic effort to identify and evaluate the potential plant enhancements to mitigate the consequences of severe accidents. The

staff considered the robustness of this conclusion relative to critical assumptions in the analysis—specifically the impact of uncertainties in the risk and cost estimates and the use of alternative benefit-cost screening criteria. The staff concludes that the findings of the analysis would be unchanged even considering these factors. Therefore the staff concludes that the mitigation alternatives committed to by the applicant are appropriate and no further mitigation measures are warranted.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 50.34, "Contents of application; technical information."

10 CFR 51.53, "Postconstruction environmental reports."

10 CFR 52.17, "Contents of application."

10 CFR 52.79, "Contents of applications; technical information."

Limerick Ecology Action vs. NRC. 869 F.2d 719 [3rd Cir. 1989].

Mubayi, V., V. Sailor, and G. Anandalingam. 1995. *Cost-Benefit Considerations in Regulatory Analysis*. NUREG/CR-6349, U.S. Nuclear Regulatory Commission, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1980. "Nuclear Power Plant Accident Considerations Under the National Environmental Policy Act of 1969." 45 FR 40101, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1985a. "Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants." 50 FR 32138, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1985b. *Safety Evaluation Report Related to the Final Design Approval of the GESSAR II BWR/6 Nuclear Island Design.* NUREG-0979, Supplement 4, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1988. Generic Letter 88-20,"Individual Plant Examination for Severe Accident Vulnerabilities." November 23, 1988, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1989. Letter from U.S. NRC to G. A. Hunger, Jr. Philadelphia Electric Company. Subject: Supplement to the Final Environmental Statement—Limerick Generating Station, Units 1 and 2. Supplement to NUREG-0974.

U.S. Nuclear Regulatory Commission (NRC). 1990. Generic Letter 88-20, Supplement 3, "Completion of Containment Performance Improvement Program and Forwarding Insights for Use in the Individual Plant Examination for Severe Accident Vulnerabilities." July 6, 1990, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1991a. "Severe Accident Mitigation Design Alternatives for Certified Standard Designs." SECY-91-229, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1991b. Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10 CFR 50.54(f)." June 28, 1991, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). April 1995. *Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2.* NUREG-0498, Suppl. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997a. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission. Final Report.* NUREG/BR-0058, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997b. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR-0184, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997c. *Final Environmental Assessment by the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Relating to the Certification of the System 80+ Standard Nuclear Plant Design.* NUREG-1462, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997d. *Final Environmental Assessment by the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Relating to the Certification of the U.S. Advanced Boiling Water Reactor Design.* NUREG-1503, Washington, D.C.

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7.4 TRANSPORTATION ACCIDENTS

RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's consideration and treatment of the assessment of transportation accidents involving radioactive materials. The scope of the review directed by this plan will be governed by the level of compliance of the proposed project with the criteria provided in 10 CFR 51.52(a).

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewer for the following ESRP, as indicated:

- ESRP 3.8. Obtain a statement regarding the compliance of proposed transportation modes with the criteria of 10 CFR 51.52(a).

Data and Information Needs

This review applies to applications for construction permits, operating licenses, and combined licenses. The data and information needed will be determined by the extent of compliance with the criteria of 10 CFR 51.52(a), generic determinations of effects of transportation accidents involving irradiated fuel falling outside those criteria, and by the nature of those proposed project details that may not comply with it. The following data or information should be obtained:

- a statement from the reviewer for ESRP 3.8 to the effect that proposed irradiated fuel characteristics and transportation modes are in compliance with the provisions of 10 CFR 51.52(a) or, when not in compliance, a statement about the nature and extent of the characteristics and modes that are not in compliance with this provision (from ESRP 3.8)

- the estimated transportation distance from the plant to the facility to which spent fuel will most likely be sent (from ESRP 3.8)

When the proposed transportation modes are not in compliance with the provisions of 10 CFR 51.52(a), the following data should be obtained:

- a description of each transportation mode that does not comply (from the environmental report [ER])

- a description of transportation accident statistics for each of the above transportation modes (from the ER)

- accident statistics for the transportation modes described in 10 CFR 51.52(a) (AEC 1972)

- the environmental effects of the transportation accidents that could occur based on the proposed transportation modes and changes or additions to Table S-4 (in 10 CFR 51.52) resulting from these potential accidents (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the assessment of transportation accidents involving radioactive materials are based on the relevant requirements of the following:

- 10 CFR 51.52(a) with respect to the design and operational parameters related to the transportation of fuel and waste to and from the reactor.

Regulatory guidelines and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP. However, there are generic determinations of environmental effects of transportation of fuel with enrichment to 5% uranium-235 by weight irradiated to a maximum of 62,000 megawatt days per ton, provided that the fuel is shipped more than 5 years after discharge from the reactor (NRC 1996, NRC 1999a, 64 FR 48496).

Technical Rationale

The technical rationale for evaluation of the applicant's transportation accident data is discussed in the following paragraph:

The transportation of fuel and waste to and from the reactor facility could result in possible accidents that could have either a radiological or nonradiological impact. The risk associated with such an occurrence is related to the type of shipment, the number of shipments, and the distance that the shipment is made.

III. REVIEW PROCEDURES

If the reviewer of ESRP 3.8 determines that the proposed transportation of radioactive materials complies with the provisions of paragraph (a) of 10 CFR 51.52, no further analysis is needed. An additional analysis of transportation accidents should be made when the reviewer of ESRP 3.8 determines that the proposed project does not comply with the following provisions of 10 CFR 51.52(a)(5):

> Unirradiated fuel is shipped to the reactor by truck; irradiated fuel is shipped from the reactor by truck, rail, or barge; and radioactive waste other than irradiated fuel is shipped from the reactor by truck or rail.

When transportation modes differing from these are proposed, the reviewer should do the following:

(1) Prepare an analysis of the modes as they apply to the proposed transportation of new fuel, irradiated fuel, and radioactive wastes.

(a) Conduct the analysis to determine whether the proposed transportation modes can result in environmental risks greater than those summarized in the "Accidents in Transport" section of Table S-4 (in 10 CFR 51.52).

(b) When it is obvious that the proposed modes do not represent an increased environmental risk, do the following:

- Terminate the analysis.
- Prepare a statement to the effect that the proposed transportation modes are within the scope of Table S-4.

(c) When this is not the case, do the following:

- Consider the accident probabilities and accident statistics for each proposed transportation mode.
- Compare these data with the probabilities and statistics considered in WASH-1238 and Supplement.
- Determine to what extent the differences will affect the accident data of Table S-4.

(2) When the proposed transportation of radioactive materials does not comply with the provisions of 10 CFR 51.52(a)(1-4), determine the extent to which transportation accidents involving radioactive materials represent an increased probability of risk to the general public over those risks shown in Table S-4, and determine whether this increase is significant. Generic determinations of environmental effects of transportation of fuel with enrichment to 5% uranium-235 by weight irradiated to a maximum of 62,000 megawatt days per ton, provided that the fuel is shipped more than 5 years after discharge from the reactor (NRC 1996, NRC 1999a, 64 FR 48496). These determinations were that the environmental impacts of the transport of irradiated fuel having these characteristics are bounded by the impacts listed in Table S-4.

(a) If the increased risk can be shown to be significant, evaluate the possibility of the use of those transportation modes described in 10 CFR 51.52(a)(5).

(b) If it is not possible to use these modes, seek other modes that project a lower risk.

(c) Ensure that estimated transportation distances for spent fuel have been considered in determining any increased probability of risks.

IV. EVALUATION FINDINGS

When the reviewer for ESRP 3.8 determines that the proposed transportation of radioactive materials complies with the provisions of 10 CFR 51.52(a), a statement similar to the following should be made:

> The transportation of new fuel to the plant, of irradiated fuel from the reactor to a storage or disposal facility,[a] and of solid radioactive waste from the reactor to burial grounds is within the scope of the Atomic Energy Commission (AEC) report entitled, *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants* (AEC 1972). The environmental risks of accidents in transportation are summarized in Table 7.4-1.

If fuel enrichment, irradiation, and cooling time exceed the criteria in 10 CFR 51.52(a) but are within the bounds covered in the generic determinations, prepare a statement that references the generic determinations and states that the environmental impacts of fuel transportation accidents are bounded by the impacts listed in Table S-4.

If an independent analysis of transportation accidents has been made, the reviewer should prepare an input that (1) describes the proposed transportation means and why they were proposed, (2) compares accident statistics for the proposed transportation modes with the statistics provided in AEC (1972), (3) discusses the increase in risk due to the proposed transportation modes, and (4) concludes that the risks are acceptable or that some alternative form of transportation is recommended for consideration. The reviewer is directed to the Transportation Accidents section of the "Draft Environmental Statement

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(a) Fuel reprocessing plant.

Table 7.4-1. Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water Cooled Nuclear Power Reactor[a]

Accidents in Transport	
Item	Environmental Risk
Radiological Effects	Small[b]
Common (Nonradiological) Causes	1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor-year.
(a) Data supporting this table are given in the Commission's *Environmental Survey of Transportation of Radioactive Materials To and From Nuclear Power Plants*, WASH-1238, December 1972; Supplement I, NUREG-75/038, April 1975.	
(b) Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single-reactor or a multireactor site.	

for Atlantic Generating Station Units 1 and 2" (NUREG-0058, *Revised Draft Environmental Statement Related to Construction of Atlantic Generating Station Units 1 and 2*) (NRC 1976) for guidance in developing this input to the environmental statement.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 57.52, "Environmental effects of transportation of fuel and waste."

Atomic Energy Commission (AEC). 1972. *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*. WASH-1238 (NUREG-75/038).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Revised Draft Environmental Statement Related to Construction of Atlantic Generating Station Units 1 and 2*. NUREG-0058, Rev. 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1999a. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3—Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants*. NUREG-1437 Vol. 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999b. Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. 64 *Federal Register* (September 3, 1999).

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ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

8.0 NEED FOR POWER

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes evaluation of the need for power. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 8.1 through 8.4.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the Commission's regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 8.1 through 8.4. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

8.1 DESCRIPTION OF POWER SYSTEM

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of the power system as it presently exists, including both service areas and regional relationships (e.g., power pool agreements, electrical transfer capabilities, diversity interchange agreements, wheeling contracts, etc.).

The scope of the review directed by this plan should include a description of (1) the service area or areas, (2) the types of customers and major electrical load centers to be served by the proposed project, and (3) system factors that are unique to the power system. This review will provide input to the reviews conducted under ESRPs 8.2, 8.3, and 8.4.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or State or regional authorities' or Independent System Operators' (ISOs') analyses concerning the need for power and energy supply alternatives after ensuring that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

The guidance in this ESRP is limited because changes in the regulatory structure are occurring as the guidance is being revised. Reviewers of issues related to the need for power should identify current NRC policy before beginning their review. Deregulation in the electricity market will have a significant impact on the analysis of the need for power. Applicants may be power generators rather than utilities; therefore, analysis of the need for power must be sufficiently flexible to accommodate the applicant type. Because of deregulation in bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate customers within a utility's traditional service area increasingly is not

met by the utility's own generating resources. Trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service. The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. "Relevant service area" is a situation-specific concept and must be defined on a case-by-case basis.

As an example of changes, the relevant service area could be interpreted as a power marketing area encompassing all of the United States east of the Rocky Mountains. The concept of "relevant region" is also introduced here to mean an area for which electricity demand forecasts are performed, such as the Northeast Power Coordinating Council region, which might or might not include the relevant service area.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 8.2.1 and 8.2.2. Identify and provide information on any anomalies of the relevant service area that may affect energy and peakload demand forecasts (e.g., an extremely large industrial customer).

- ESRP 8.3. Provide a list of factors that may affect power supply, such as diversity interchange agreements, wheeling arrangements, etc.

- ESRP 8.4. Provide a list of power pooling agreements as they might impact reserve margin criteria.

- ESRP 9.1. Provide a list of factors that might encourage or impede the possibility of purchasing electrical power rather than installing new generating capacity.

- ESRP 9.3. Identify and provide information on the geographical boundaries of the applicant's service area(s).

Data and Information Needs

Affected States and/or regions are expected to prepare a need-for-power evaluation. NRC will review the evaluation and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found acceptable, no additional independent review by NRC is needed, and the analysis can be the basis for ESRPs 8.2 through 8.4.

As part of their analyses of the need for power, States and/or regional authorities are expected to describe and assess the regional power system. The reviewer should evaluate the description and determine if it is comprehensive and subject to confirmation. If it is found acceptable, no additional data collection by NRC should usually be needed. These data may be supplemented by information sources such as the Energy Information Administration, FERC, the North American Electric Reliability Council, and others.

If an analysis meeting the preceding criteria is not available, the following data or information should be obtained by NRC staff for review of the applicant's need-for-power analysis:

- a map indicating the geographical and political boundaries of the relevant service area. The map should indicate major electrical load centers and major intertie-transfer capabilities with neighboring utility systems. If there are no specific system boundaries, the staff should obtain the best possible description of typical competitors and satisfy themselves that the proposed facility will be competitive in that market.

- the current population and the number and types of customers in the relevant service area

- the percentage of electricity (in terms of total electrical energy) that the applicant supplies to each State in the relevant service area. Include percentages for residential, commercial, and industrial customers.

- identification of the power pool (if applicable) or alternative mutual assistance arrangements in which the applicant may be a participant, and the commitments of its members in terms of reserve margin requirements, planning, and joint ownership of generating capacity

- the planning and coordinating functions of the appropriate electric reliability council

- a map of the power pool (if applicable) and the electric reliability council region that identifies geographical boundaries and FERC's power supply areas.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the power system are based on the relevant requirements of the following regulations:

- 10 CFR 51, Appendix A(4), with respect to discussion of the no-action alternative in NRC EISs

- 10 CFR 51.71(d) with respect to analysis of alternatives

- 10 CFR 51.71(e) with respect to weighing the costs and benefits of the proposed action and reasonable alternatives

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains a description of the existing power system.

Technical Rationale

The technical rationale for evaluating the applicant's description of the power system is discussed in the following paragraphs:

An understanding of the existing regional power system is needed to perform an independent evaluation of the need for power, to evaluate the no-action alternative and the proposed action, and to compare the proposed action with other alternatives.

The description of the power system should be adequate to permit an independent analysis of the need for power and alternatives when considered with other factors covered in ESRPs 8.2.1, 8.2.2, and 8.3.

III. REVIEW PROCEDURES

If an independent review of the need for power is to be conducted by NRC staff in lieu of using a review prepared by affected States and/or regions or ISO, the procedures discussed below should be followed. These procedures also may be used by the reviewer as an aid in evaluating forecasts prepared by others.

(1) Obtain the required information for this analysis from

- Section 1 of the applicant's environmental report
- bond rating services
- the applicant's annual report
- data filed by the applicant with FERC and the applicable State public utility commission.

(2) Examine the geographical boundaries of the applicant's service area, the power pool (if applicable), and the electric reliability region of which the applicant is a part. If no such boundaries are relevant, determine the probable competitors for the proposed facility using whatever reputable power market analysis is available.

(a) Identify major electrical load centers on the map of the relevant service area.

(b) Examine the current population and the number and types of customers in the relevant service area.

(c) Identify the major types of industry and commerce existing in the service area (if applicable).

(3) Identify the appropriate electric reliability council region.

(a) Examine any pertinent power pool agreements.

(b) Examine the applicant's major power purchases/sales with neighboring utility companies.

(c) Examine any wheeling or diversity interchange agreements.

(4) Ensure that the information and data derived from the analysis are adequate to serve as a basis for characterizing the applicant's service area and its regional relationships.

(a) Identify any unusual features that affect subsequent evaluations of the need for power (e.g., large industrial customers, a noncontiguous service area).

(b) Ensure that these features are accounted for and have been explained.

IV. EVALUATION FINDINGS

The information and data obtained from this analysis should be organized into subsections as follows:

- A brief introductory paragraph that contains the name(s) of the applicant(s), the percentage share of the proposed plant that each applicant will own, the station name, the number of generating units proposed, the net electrical rating of each proposed unit, and the applicant's proposed month and year of initial commercial operation of each unit.

- A section that contains maps indicating the geographical and political boundaries of the relevant service area, the power pool (if applicable), and the appropriate electric reliability region. The service-area map should indicate electrical transfer capabilities between the applicant and neighboring utilities and also the major electrical load centers. The population to be served by the applicant should be stated along with the area of the system (in square kilometers). Major types of customers should be identified as well as any atypical situations (e.g., an extremely large industrial customer). The primary types of industry and commerce for the region should also be identified.

- A section that contains a brief description of any relevant power pool and appropriate electric-reliability council(s). A brief discussion of any major existing or proposed power sales/purchases or diversity interchange agreements within the region should be included. If the applicant is a member of a power pool, a brief discussion should be presented regarding the legal commitments of the power pool members in terms of reserve margin requirements, planning, and sharing generating capacity.

- Alternatively, describe the probable competitors for the proposed facility, based on any reputable analysis, and discuss the marketability of power from the proposed facility together with any significant market competitors and risks.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(4), "Purpose and need for action."

10 CFR 51.71, "Draft environmental impact statement—contents."

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminatory Transmission Services by Public Utilities," 61 *Federal Register* 21540.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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8.2 POWER DEMAND

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the demand for electricity. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 8.2.1 and 8.2.2.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's power demand is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared for ESRP 8.2 is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 8.2.1 and 8.2.2. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

U.S. NUCLEAR REGULATORY COMMISSION

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8.2.1 POWER AND ENERGY REQUIREMENTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and evaluation of the historic and projected electricity consumption and peakload demands in the relevant service area or market. The scope of the review directed by this plan should include a detailed analysis and evaluation of the applicant's treatment of these projections and, where needed, an independent assessment of forecasts of the service area growth in electricity consumption and peakload demand.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or State or regional authorities' or Independent System Operators' (ISOs') analyses concerning the need for power and energy supply alternatives after ensuring that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

The guidance in this ESRP is limited because changes in the regulatory structure are occurring as the guidance is being revised. Reviewers of issues related to the need for power should identify current NRC policy before beginning their review. Deregulation of utilities will have a significant impact on the analysis of the need for power. Applicants may be power generators rather than utilities; therefore, analysis of the need for power must be sufficiently flexible to accommodate the applicant type. Because of deregulation in bulk-sales markets for electricity, the advent of independent power producers, and the increased use of purchases and exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate customers within a utility's traditional service area increasingly is not met by the utility's own generating resources. Trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file

open-access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service. The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. Relevant service area is a situation-specific concept and must be defined on a case-by-case basis.

As an example of changes, the relevant service area could be interpreted as a power marketing area encompassing all of the United States east of the Rocky Mountains. The concept of "relevant region" is also introduced here to mean an area for which electricity demand forecasts are prepared, such as the Northeast Power Coordinating Council region, which might (or might not) include the relevant service area.

Review Interfaces

The reviewer for this ESRP should obtain input from and provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 8.1. Obtain a description of the power system in the relevant service area. Special attention should be given to anomalies, such as extremely large industrial customers, that may affect energy and peak load forecasts.

- ESRP 8.2.2. Obtain data on power and energy requirements and provide the historic and projected growth data that are considered appropriate for the relevant service area to support the forecast analysis. This may or may not be the applicant's historical service area, even if the applicant is a traditional electric utility.

- ESRP 8.4. Provide the range of forecasts developed from this plan for assessing the need for baseload generating units of the proposed capacity.

- ESRPs 9.1 and 9.2.1. Provide the power and energy requirements as determined through this analysis.

Data and Information Needs

Affected States and/or regions continue to prepare need-for-power evaluations for proposed energy facilities. The NRC will review the evaluation and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. Forecasts should include demand scenarios for midrange, high, low, 75th percentile, and 25th percentile conditions. If the need-for-power evaluation is found acceptable, no additional independent review by the NRC is needed, and the analysis can be the basis for ESRPs 8.2 through 8.4.

If an analysis meeting the preceding criteria is not available, the following data or information should be obtained by NRC staff for review of the applicant's need-for-power analysis:

- historical and projected electrical energy use by major categories in the relevant service area. Data should cover the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units. Major categories are those that account for 5% or more of the relevant service area consumption, including residential, commercial, industrial, agricultural, large special loads (such as Federal installations or highly electricity intensive industries), street lighting, municipal systems and co-ops, other utilities, and rapid transit systems.

- forecasts of all aggregate long-range consumption and system peakload demand made during the 15 years preceding the date of application

- the yearly increase in total kilowatt-hour (kWh) sales for the 15 years preceding the date of application and an average annual compound growth rate for this period

- a normalized kWh sales growth rate that accounts for unusual changes (e.g., weather and fluctuations in major loads not representative of system growth), a list of the changes considered, and the method of normalization

- a description of the methodologies used in forecasting (e.g., econometric, extrapolation, judgment, and surveys) showing all major factors considered in arriving at the forecast, how these factors were introduced to the forecast, and an estimate of their likely effect on the growth of kWh sales and peakload demand in the service area

- the historic and projected relevant service area season of peakload demand (summer-winter) for the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units

- the historic and projected relevant service area load factor (average load/peakload) for the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units; where shifts in load factor or load factor trends are evident, identification of the principal factors contributing to these shifts or trends

- the yearly increase in regional system peakload demand for the 15 years preceding the date of application and an average annual compound growth rate for this period

- a normalized regional system peakload rate that accounts for unusual changes (e.g., weather, interruptible contracts, and fluctuations in major loads not representative of system growth), a list of the changes considered, and the method of normalization

- load duration curves for the current year and for the 1st year of commercial operation of the first proposed unit

- the minimum hourly load for the current year and for the 1st year of commercial operation of the first proposed unit.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the power and energy requirements are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A(4), with respect to discussion of the no-action alternative in NRC environmental impact statements (EISs).

- 10 CFR 51.71(e) with respect to weighing the costs and benefits of the proposed action and reasonable alternatives.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to electrical demand and projections.

Technical Rationale

The technical rationale for evaluating the applicant's power and energy requirements is discussed in the following paragraphs:

Section 4 of Appendix A to 10 CFR 51 specifically requires that the no-action alternative be discussed in an NRC EIS. ESRP 8.2.1 will aid this analysis by providing information to enable an analysis to be made in ESRP 8.4 of the need for power from the proposed power plant.

10 CFR 51.71(e) states that a draft EIS is to contain a preliminary recommendation respecting the proposed action "reached after weighing the costs and benefits of the proposed action and considering reasonable alternatives." ESRP 8.2.1 will aid this determination by providing input that can be used to evaluate the need for power and the potential benefits of the proposed action and the alternatives.

III. REVIEW PROCEDURES

If an independent review of power and energy requirements is to be conducted by NRC staff in lieu of using a review prepared by affected States and/or regions, the procedures discussed below should be followed. These procedures also may be used by the reviewer as an aid in evaluating forecasts prepared by others. These procedures assume that the applicant is a traditional utility. Industry best practice may evolve as a result of deregulation. The reviewer should be aware of, and use, industry best practice where possible.

(1) Analyze the historical data and forecasts of demand factors for completeness and agreement with other forecasts, emphasizing the forecasted growth in kWh sales.

(2) Analyze the forecasting methodologies employed to the extent needed to reach conclusions regarding their acceptability. Relevant factors to consider include the following:

- price of electricity
- energy efficiency and substitution
- price of alternative fuels
- income
- economic activity
- number of customers
- weather
- saturation levels
- treatment of uncertainty.

(3) Consider how the demand influencing factors are taken into account. If scientific methodologies are employed, determine if they pass standard tests of acceptability (e.g., statistical tests of significance).

(4) Analyze any parameter estimates (e.g., price and income elasticities) obtained by the applicant's methodologies to determine the degree to which they agree with other estimates that are generally available for the relevant region from State or regional sources. Compare the applicant's latest projections with those made earlier for the same or overlapping time periods.

(5) Evaluate the applicant's forecasts and the data and methodology used to make these forecasts and reach one of the following conclusions:

(a) The applicant's forecast and all data and methodologies are verified by the staff analyses, and the reviewer concludes that the methodology, underlying assumptions, and results are similar to those that would have been used and obtained by the staff.

(b) The applicant's forecasts, methodologies, and data used cannot be verified by the staff. In this case, the staff should perform an independent assessment using independent forecasting models and underlying assumptions.

(6) Use the following approach for conducting independent assessments of forecasts of service area growth in electricity consumption and peakload demand:

(a) Consider independent forecasting methods to obtain from each a growth rate forecast that is viewed as reasonable by the staff.

(b) Determine if other methods (e.g., for the service area or specifically for the region) are available and consider their use for this assessment.

(c) In applying the selected methods, conduct a parametric analysis, based on a range of plausible growth rates, against which the applicant's projected growth rate is compared to determine reasonableness.

- The selection of additional methods should be based partially on geographic compatibility and partially on the method sophistication.

- Wherever possible, all methods used should be adjusted to reflect important service area trends and characteristics.

(d) Use the results of these methods to prepare comparable peakload forecasts.

IV. EVALUATION FINDINGS

Input from analysis of this ESRP should be designed to accomplish the following objectives: (1) public disclosure of the applicant's forecasts of peakload and electrical energy demand and (2) presentation of the staff's evaluation regarding the completeness and adequacy of these forecasts.

When the reviewer has determined that a forecast made by or for one or more State or regional agencies is complete and adequate, the following information should be included in the environmental impact statement (EIS):

- the forecast methodology used by the State or regional agency
- summaries of the data used
- forecasts made by the State or regional agency and the basis for the staff's determination of the adequacy of these forecasts.

If the reviewer determines that the State or regional forecast is complete and adequate, the reviewer should provide input to the EIS similar to the following:

> The staff reviewed the information provided by the State or regional body, verified the forecast of electricity consumption and peak-load demands, and concluded that the results are complete and adequate.

When the need for power analysis has been prepared by the applicant and the reviewer has determined that the applicant's forecasts are complete and adequate, the following information should be included in this section of the EIS:

- the forecast methodology used by the applicant
- summaries of the data used, together with the staff's evaluation of the data
- forecasts made by the applicant and the basis for the staff's evaluation of the adequacy of these forecasts.

In this case, the staff would provide input to the EIS similar to the following:

> The staff reviewed the information provided by the applicant, verified the applicant's forecast of electricity consumption and peak load demands, and concluded that the results are complete and adequate.

When the reviewer has performed an independent analysis, the following information may be included in this section of the EIS:

- for each method, a description of the method, the explanatory variables used, the parameter estimates generated, and the assumed growth rates for each of the explanatory variables
- a description and justification of any changes made in the method by the reviewer. (These will typically be with respect to assumed growth rates in explanatory variables and in some cases adjustments to elasticity estimates.)
- a description of the assumptions and techniques used to convert the energy growth forecasts to peakload growth forecasts
- the ranges for energy growth and peakload growth that have been determined to be reasonable.

For this case, the staff would provide input to the EIS similar to the following:

> The staff performed an independent assessment using independent forecasting methods and underlying assumptions. The results of these methods were used to prepare peakload forecasts. The staff concludes that these forecasts are adequate and in appropriate detail for further analyses.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(4), "Purpose and need for action."

10 CFR 51.71, "Draft environmental impact statement—contents."

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminating Transmission Services by Public Utilities," 61 *Federal Register* 21540.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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8.2.2 FACTORS AFFECTING GROWTH OF DEMAND

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification, analysis, and evaluation of factors contributing to the rate of growth of electricity demand in the applicant's service area.

The scope of the review directed by this plan should include economic and demographic trends, conservation, substitution, and price and rate structure as these factors may affect the rate of growth of electricity demand.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or State or regional authorities' or Independent System Operators' (ISOs') analyses concerning the need for power and energy supply alternatives after ensuring that the analysis of the need for power and alternatives is reasonable and meets high-quality standards.

The guidance provided in this ESRP is limited because changes in the regulatory structure are occurring as the guidance is being revised. Reviewers of issues related to the need for power should identify current NRC policy before beginning their review. Economic deregulation of utilities will have a significant impact on the analysis of the need for power. Applicants may be power generators rather than utilities; therefore, analysis of the need for power must be sufficiently flexible to accommodate the applicant type. Because of deregulation in bulk sales markets for electricity, the advent of independent power producers and the increased use of purchases and exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate customers within a utility's traditional service area increasingly is not met by the utility's own generating resources. Trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring

all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open-access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service. The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. Relevant service area is a situation-specific concept and must be defined on a case-by-case basis.

As an example of changes, the relevant service area could be interpreted as a power-marketing area for independent power generators. The concept of "relevant region" is also introduced here to mean an area for which electricity demand forecasts are done, such as the Northeast Power Coordinating Council region, which would include the relevant service area.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 8.2.1. Provide data on the power and energy requirements to support the forecast analysis.
- ESRP 8.4. Provide information pertaining to baseload capacity planning to support the evaluation of the need for the plant.
- ESRPs 9.1, 9.2.1 and 9.2.2. Provide information pertaining to those factors affecting growth of electricity demand that could affect the need for or choice of alternative energy sources and systems.

Data and Information Needs

Affected States and/or regions continue to prepare a need-for-power evaluation for proposed energy facilities. The NRC will review the evaluation for the proposed facility, if available, and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the State/regional need-for-power evaluation is found to be acceptable, no additional independent review by NRC is needed, and the State or regional analysis can be the basis for ESRPs 8.2 through 8.4.

If an analysis prepared by or under the direction of one or more State or regional agencies meeting the preceding criteria is not available, the following data or information should be obtained by NRC staff for review of the applicant's need-for-power analysis:

- historical and estimated growth for the relevant service area (or close geographic approximation) of the following variables: population, number of households, per capita income, consumer price index, manufacturing output, gross regional product, saturation by major appliance, trends in size of household, and prices of alternative fuels. Data should cover the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units.

- historical temperature adjusted peakload data for the 10-year period preceding the application submittal date

- for the 5 years preceding the date of application, the percentage of residences in the relevant service area relying on oil and the percentage relying on gas for space conditioning, water heating, and operating major appliances; similarly, for industries in the relevant service area, the percentages of total energy requirements being met by oil and gas over this same time period

- from the date of application to 3 years after initial commercial operation of the first proposed unit, the generally known availability of oil and gas to ultimate customers in the relevant service area (e.g., gas curtailments and status of gas hookups to new customers)

- for the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units, the historic and projected growth for the relevant service area of the real price of electricity by major customer class

- the current and projected rate structures (at time of first-unit startup) for major customer classes

- the relevant region's efforts to conserve and promote customer conservation of electrical energy.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the factors affecting growth of demand are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A(4), with respect to discussion of the no-action alternative in NRC environmental impact statements (EISs)

- 10 CFR 51.71(d) with respect to analysis of alternatives

- 10 CFR 51.71(e) with respect to weighing the costs and benefits of the proposed action and reasonable alternatives.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to electrical demand and projections.

Technical Rationale

The technical rationale for application of these acceptance criteria is discussed in the following paragraphs:

NRC's regulations implementing the National Environmental Policy Act (NEPA) in 10 CFR 51, Appendix A, contain the format for presentation of material in EISs. Section 4 of Appendix A specifically requires that the no-action alternative be discussed in an NRC EIS. ESRP 8.2.2 will aid this analysis by providing information to enable an analysis to be made of the need for power from the proposed power plant.

NRC's regulations implementing NEPA also include 10 CFR 51.71, which specifies the content requirements for draft EISs. It is stated in 10 CFR 51.71(d) that a draft EIS is to include "a preliminary analysis that considers and balances the environmental and other effects of the proposed action and the alternatives available for reducing or avoiding adverse environmental and other effects." In addition to providing input for analysis of the no-action alternative, the review under ESRP 8.2.1 will aid this analysis by providing, as input to ESRP 9.1.1, information pertaining to those factors affecting the growth of electricity demand that could affect the choice of alternative energy sources and systems.

It is stated in 10 CFR 51.71(e) that a draft EIS is to include a preliminary recommendation respecting the proposed action "reached after weighing the costs and benefits of the proposed action and considering reasonable alternatives." The review conducted under ESRP 8.2.2 will aid this determination by providing input that can be used to evaluate the need for power and the potential benefits of the proposed action and the alternatives.

III. REVIEW PROCEDURES

If an independent review of need for power is to be conducted by NRC staff in lieu of using a review prepared by affected States and/or regions, the procedures discussed below should be followed. These procedures also may be used by the reviewer as an aid in evaluating forecasts prepared by others. The procedures assume a traditional utility. Industry best practice may evolve as a result of deregulation. The reviewer should be aware of, and use, industry best practice where possible.

Economic and Demographic Trends

(1) Analyze the applicant's estimates of the effects of economic and demographic trends on the applicant's projected growth of electricity demand in the relevant service area.

(2) Obtain or prepare independent forecasts for the economic and demographic variables identified by the applicant as affecting the rate of growth of electricity demand within the relevant service area.

(3) Consider additional variables when it appears that they could affect electricity demand growth.

Forecasts prepared for service areas other than those to be served by the applicant may be used when in the reviewer's judgment they are sufficiently similar to provide a meaningful comparison.

(4) For each variable used by the applicant,

(a) Compare the applicant's projected growth rates with growth rates developed or obtained by the reviewer.

(b) Identify differences.

(c) Analyze significant differentials as they contribute either positive or negative effects to the applicant's forecasted growth rate of electricity demand.

(5) Compare the historic growth of these variables with the forecasted growth rates, and identify differences as positive or negative influences on projected electricity demand growth.

Energy Efficiency and Substitution[a]

(1) Estimate the importance of energy efficiency and substitution in the relevant service area by preparing an estimate of the effect of these factors on projected kilowatt-hour (kWh) sales and peak demand in the relevant service area for the proposed initial year of plant operation (first unit).

(a) Contrast this estimate with that of the applicant.

(b) Note any significant differences between the two estimates.

(c) Calculate the annual compound growth rate in kWh sales and peakload for the last 15 years and compute the increase or decrease in growth rates during the period.

(2) Identify those elements that could have contributed to diminished growth. The list should include the following

- increases in energy efficiency
- higher prices of electricity
- economic recession
- milder than usual weather.

(3) Estimate the relative effects of energy efficiency, price, recession, and weather on diminished growth using the following analyses:

(a) Compare the real rate of change in the average price of a kWh of electricity in the service area in the last 15 years and contrast with the real rate of change nationally.

(a) For this ESRP, substitution is defined as the substitution of electricity for other fuels.

(b) Compute the real rate of change in the gross regional product for the relevant service area (or geographic approximation) in the last 15 years with the real rate of increase in gross national product.

(c) Review peakload growth in the last 15 years (adjusted for temperature) and discuss positive or negative effects on observed growth rate.

(4) Consider the effect of substitution on growth using the following analyses:

(a) Review the importance of oil and gas in the relevant service area relative to their availability. Consider any curtailments or denials to new customers (residential, industrial, and commercial) if they exist. Determine the relevant service area's dependence on fossil fuels and the ratio between demand and available supply.

(b) Identify trends in new homes (all-electric versus other), purchases of new appliances (electric vs. other), and shifts in industrial energy and commercial energy requirements. Determine if electricity is capturing or losing an increasing share of the new and replacement market, and the reasons for the increasing or decreasing share.

(5) Determine the extent to which the future substitution between electrical energy and fuels such as oil and natural gas may tend to increase or decrease the demand for electric power and thus offset or reinforce the impacts of energy efficiency measures.

(6) Consider any estimates developed by the applicant with respect to the impact of substitution on realized growth rate and determine any adjustments to growth forecasts that may have been made to reflect the substitution.

(7) Consider the following factors as they contribute to electricity demand growth:

(a) the extent to which technological breakthroughs, government legislation and subsidies, and large energy efficiency investments may provide greater energy efficiency savings than have been experienced in the past

(b) the extent to which energy sources (e.g., synthetic natural gas) or energy conversion systems (e.g., solar space heating) currently under development may reasonably be expected to compete with the use of electricity. Consult with the reviewer of ESRP 9.2 to complete this portion of the review.

(c) the possibility that long-term savings may not be particularly significant

(d) the possibility that improvements in energy efficiency would result in decreased use of electric power

(e) the possibility of "double counting" energy savings (e.g., energy efficiency is an economic response).

Price and Rate Structure

(1) Determine how and to what extent the applicant has considered price response in demand forecasts.

(a) Where the applicant has developed and/or used an econometric model, identify the applicant's price elasticities, forecasted growth rates for the price of electricity, and treatment of price competition.

(b) Obtain independent forecasts of growth in the real price of electricity.

(c) Compare these forecasts with the treatment of price in the applicant's analysis.

(2) Consider the effects of price competition and alternative rate structures that would moderate load growth or reshape load curves.

(a) Consider alternative rate structures such as peakload pricing, inverted rates, and flattened rates.

(b) Analyze the relevant region's present attempts and future plans to improve the system load factor via rate restructuring (e.g., higher tail rate during peak periods and demand charges that are based on maximum demand).

(c) Estimate anticipated effects on annual electricity consumption and peakload demand.

(3) Determine to what extent economic and demographic trends, energy efficiency and substitution, open competition, and price and rate structure are likely to affect the rate of growth of electrical demand. This determination should be based on the following information:

- the effect of economic and demographic variables on the expected growth of electricity demand
- the effect of energy efficiency improvements and substitution on projected kWh sales and peak demand
- the effect of price competition and the growth in the real price of electricity on the expected growth of electricity demand
- the capability of present and proposed rate structures to promote load management.

(4) Ensure that the data and analyses submitted by the applicant are accurate and in sufficient detail to allow one to conclude that the forecast submitted by the applicant properly reflects the factors listed above.

(a) If the reviewer concludes that the applicant has taken reasonable account of these factors in its forecast, the reviewer can endorse the applicant's forecast.

(b) If the reviewer determines by analysis that adequate consideration has not been given to the factors listed above, see ESRP 8.2.1 to develop an independent range of electricity-demand growth to determine if the differences in the treatment of these factors affect the reasonableness of the applicant's ultimate growth rate.

IV. EVALUATION FINDINGS

If a need-for-power analysis prepared by or under the direction of affected States is determined and an analysis is conducted by NRC staff, the ESRP 8.2.2 analysis will normally be divided into three subsections consisting of a discussion of the applicant's treatment of economic and demographic trends, energy efficiency improvements and substitution, and price and rate structure. The following information should be included in each of these subsections.

Economic and Demographic Trends

This section should include a comparison of the applicant's estimates of the effect of economic and demographic trends on electricity-demand growth with independent analyses of those effects by State and regional authorities or NRC staff. Any significant differences should be noted, and the reviewer should indicate what appears to be the most appropriate estimate.

The reviewer should provide a concluding statement in the EIS similar to the following:

> The staff reviewed the data and analyses submitted by the applicant and determined that they are reasonable and in sufficient detail to conclude that the forecast submitted by the applicant properly reflects the effect of economic and demographic variables on the expected growth of electricity demand.

Energy Efficiency and Substitution

The reviewer should provide a qualitative assessment as to the effectiveness of energy efficiency improvements in the last several years given industry restructuring, price changes, recession, and weather. Successful efforts undertaken within the relevant region to promote energy efficiency on the part of customers and with respect to internal use of power transmission and distribution efficiency and demand side management should be included.

The reviewer should present any other significant factors that could affect the growth of electricity demand in the service area.

The reviewer should provide a concluding statement in the EIS similar to the following:

The staff reviewed the data and analyses submitted by the applicant and other data and determined that they are reasonable and in sufficient detail to conclude that the forecast submitted by the applicant properly reflects the effect of energy efficiency and substitution on projected kWh sales and peak demand.

Price and Rate Structure

The reviewer should describe present and proposed price and rate structures and discuss how price competition and utility price and rate structure may affect the growth of electricity demand.

The reviewer should provide a concluding statement in the EIS similar to the following:

The staff reviewed the data and analyses submitted by the applicant and determined that they are reasonable and in sufficient detail to conclude that the forecast submitted by the applicant properly reflects the effect of the growth in the real price of electricity on the expected growth of electricity demand, and the capability of present and proposed rate structures to promote load management.

If a need-for-power analysis prepared by or under the direction of affected States or regions is available, the ESRP 8.2.2 analysis may be divided into three subsections as above, or it may consist of a single section summarizing the relevant aspects of the region's need for power.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(4), "Purpose and need for action."

10 CFR 51.71, "Draft environmental impact statement—contents."

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminating Transmission Services by Public Utilities," 61 *Federal Register* 21540.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

8.3 POWER SUPPLY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and evaluation of the present and planned generating capability and the present and planned purchases and sales of power and energy. The scope of the review directed by this plan will include consideration of the type (e.g., coal-fired) and function (e.g., baseload) of the relevant region's plants, the nature of purchases and sales (firm and nonfirm) of power and energy, and any proposed additions, retirements, redesignations, deratings, or upratings of the relevant region's plants.

In performing this review, the reviewer may rely on the analysis in the applicant's ER and/or State or regional authorities' analyses concerning the need for power and energy supply alternatives. The reviewer should ensure that the analysis of the need for power and alternatives is reasonable and meets high-quality standards.

The analysis of purchases and sales should consider the fact that substantial amounts of electricity are now bought and sold between regions in the country and between utilities in the same region. Such trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open-access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service.

The guidance provided in this ESRP is limited because changes in the regulatory structure are occurring as the guidance is being revised. Reviewers of issues related to the need for power should identify current NRC policy before beginning their review. Deregulation of utilities will have a significant

impact on the analysis of the need for power. Applicants may be power generators rather than utilities; therefore, analysis of the need for power must be sufficiently flexible to accommodate the applicant type. Because of deregulation in bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate customers within a utility's traditional service area increasingly is not met by the utility's own generating resources. Trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open-access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service. The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. Relevant service area is a situation-specific concept and must be defined on a case-by-case basis.

As an example of changes, the relevant service area could be interpreted as a power marketing area encompassing the entire United States east of the Rocky Mountains. The concept of "relevant region" is also introduced here to mean an area for which electricity-demand forecasts are performed, such as the Northeast Power Coordinating Council region, which might or might not include the relevant service area.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated.

- ESRP 8.1. Obtain input on factors that may affect power supply, such as diversity interchange agreements, wheeling arrangements, etc.

- ESRP 8.4. Provide assurance that descriptions of the region's existing and planned sources of power and energy satisfy the requirements of the reviewer of ESRP 8.4.

- ESRP 9.2.2. Provide any data concerning restrictions on the use of energy sources available to the region.

Data and Information Needs

Affected States or regions continue to prepare need-for-power evaluations for proposed energy facilities. The NRC will review the evaluation for the proposed facility and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the State's or region's need-for-power evaluation is found acceptable, no additional independent review by NRC is needed, and the State's analysis can be the basis for ESRPs 8.2 through 8.4.

As part of their analyses of the need for power, States and/or regional authorities are expected to provide a description and assessment of the regional power system. The reviewer should evaluate the description

and determine if it is comprehensive, subject to confirmation, and includes the following data. If it is found acceptable, no additional data collection by NRC should usually be needed. These data may be supplemented by information from sources such as the Energy Information Administration, the Federal Energy Regulatory Commission, North American Electric Reliability Council, and others.

If an analysis prepared by or under the direction of one or more State agencies or regional authorities meeting the preceding criteria is not available, the following data or information should be obtained by NRC staff for review of the applicant's need-for-power analysis:

- planned generating capability at the expected peakload period of each year, beginning with the year of application (current year) and continuing through the 3rd year of commercial operation of the proposed project

- a listing of each generator with a capacity of 100 MWe or more in operation at the time of application; planned and proposed capability additions thereafter, including scheduled date of operation, retirements or deratings, redesignation (e.g., baseload to intermediate); and upratings for 3 years after operation of the proposed project. Each generator should be categorized as to type (e.g., hydroelectric, coal, oil, gas, nuclear, or pumped storage) and function (i.e., baseload, intermediate, or peaking). Estimates of projected capacity factor ranges and average variable costs for each unit tabulated should be provided. Small peaking units may be lumped into a single category for simplicity.

- definitions of the terms baseload, intermediate, peaking, firm, and nonfirm sales and purchases as applicable to the relevant regional system

- the ratio of baseload capacity to total capacity for the 15 years preceding the date of the application, and for each year through the 3rd year of commercial operation of the proposed project

- the energy to be generated by function and type of all facilities for the 1st year of commercial operation of the proposed project

- factors that affect or may affect power plant availability (e.g., plant reliability, environmental regulations, and scarcity of fuels)

- annual net firm and nonfirm power sales and purchases or interchange agreements for the year of application and for each subsequent year through the 3rd year of commercial operation of the proposed project.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the relevant region's power supply are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A(4), with respect to discussion of the no-action alternative in NRC environmental impact statements (EISs)
- 10 CFR 51.71(d) with respect to analysis of alternatives
- 10 CFR 51.71(e) with respect to weighing the costs and benefits of the proposed action and reasonable alternatives.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to descriptions of the power system additions, retirements, etc.

Technical Rationale

The technical rationale for evaluating the applicant's power supply is discussed in the following paragraphs:

The NRC's regulations implementing the National Environmental Policy Act (NEPA) at 10 CFR 51 include Appendix A, containing the format for presentation of material in EISs. Section 4 of Appendix A specifically requires that the no-action alternative be discussed in an NRC EIS. The review conducted under ESRP 8.3 will aid this analysis by providing information to enable an analysis to be made under ESRP 8.4 of the need for power from the proposed power plant.

NRC's regulations implementing NEPA also include 10 CFR 51.71, which specifies the content requirements for draft EISs. It is stated in 10 CFR 51.71(d) that a draft EIS is to include "a preliminary analysis which considers and balances the environmental and other effects of the proposed action and the alternatives available for reducing or avoiding adverse environmental and other effects." In addition to providing input for analysis of the no-action alternative, the review conducted under ESRP 8.3 will aid this analysis by providing as input to ESRP 9.1 data concerning restrictions on the use of energy sources that are applicable to the applicant.

It is stated in 10 CFR 51.71(e) that a draft EIS is to include a preliminary recommendation respecting the proposed action "reached after weighing the costs and benefits of the proposed action and considering reasonable alternatives." The review conducted under ESRP 8.3 will aid this determination by providing input, which can be used to evaluate the need for power and the potential benefits of the proposed action and the alternatives.

III. REVIEW PROCEDURES

If an independent review of the need for power is to be conducted by NRC staff in lieu of using a review prepared by affected States and/or regions, the procedures discussed below should be followed. These procedures also may be used by the reviewer as an aid in evaluating forecasts prepared by others. The procedures assume a traditional utility. Industry best practice may evolve as a result of deregulation. The reviewer should be aware of, and use, industry best practice where possible.

(1) Segregate the regional plants by fuel type and consider the present and future availability of the indicated fuel.

   (a) Identify any factors (e.g., air quality regulations or forced outages of long duration) that have affected past plant availability or capacity factor.

   (b) Consider how these factors may affect planned availability or capacity factor.

(2) Relate the applicant's definitions of baseload, intermediate, and peaking plants to other accepted uses of these terms. Where the applicant's designations do not conform to accepted uses, determine the reason for the differences.

(3) Analyze the region's present and planned generation mix in light of the region's present and planned purchases and sales (firm and nonfirm) of power and energy.

   (a) Include nonfirm purchases and sales of power when considering the capability of the relevant region's power system.

   (b) Include firm sales and purchases of power when considering the applicant's peakload responsibility.

   (c) Consider the relevant region's and applicant's role as either a net purchaser or net seller.

   (d) Quantify shifts in the relevant region's and applicant's position over time, i.e., whether the region and applicant are becoming more dependent or less dependent on purchasing power from or selling power to other systems.

   (e) Identify and determine the reasons for any unusual purchases or sales that have occurred.

   (f) Consider the possibility of a reduction in overall capacity requirements for the region that could be accomplished by the wheeling and pooling of power.

(4) Where the relevant region plans deratings, redesignations, or retirements (whose total is 200 MW or more) within approximately 2 years before or after the proposed date of commercial operation of the proposed project, determine the reasons for such a change.

(a) Determine the reasons for all 100-MW or larger unit redesignations or retirements.

(b) Analyze the historical, present, and projected ratio of baseload capacity to total capacity and determine reasons for any large variations in this ratio over time.

(5) Determine whether

- the description of present and planned capacity correctly identifies baseload, intermediate, and peaking units and that planned additions are reasonable
- the description of present and planned purchases and sales of power and energy correctly identifies the applicant's capabilities to sell or need to purchase
- plans for redesignation or re-rating of generating capacity have been explained and are reasonable
- the proposed baseload fraction of the applicant's total capacity is appropriate.

IV. EVALUATION FINDINGS

If a need-for-power analysis prepared by or under the direction of affected States or regions is unavailable, and an analysis is conducted by NRC staff, the 8.3 analysis will normally be divided into two subsections: existing and planned generating capacity and purchases and sales. These are discussed below.

Existing and Planned Generating Capacity

This discussion should summarize the relevant region's present and planned generating capacity. The relevant region's present capacity by type and any planned additions, upratings, deratings, and retirements (by unit) should be shown in a table. The capacity in the relevant power pool and reliability council should also be summarized and supported by a table (or tables) when appropriate, such as Table 8.3-1.

Purchases and Sales

This discussion should summarize the effect of purchases and sales on relevant regional load and capability. The reviewer should distinguish between (1) energy and power sales (or purchases), (2) firm and nonfirm sales (or purchases), and (3) on-peak and off-peak sales (or purchases). A table such as Table 8.3-1 may support the discussion.

If a need-for-power analysis prepared by or under the direction of affected States or regional authorities is available, input to the EIS from ESRP 8.3 may be divided into two subsections as above or it may consist of a single section summarizing the relevant aspects of the State's need-for-power analysis.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(4), "Purpose and need for action."

10 CFR 51.71, "Draft environmental impact statement—contents."

Regulatory Guide 4.2, Rev. 2. 1976. *Preparation of Environmental Reports for Nuclear Power Stations.*

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminating Transmission Services by Public Utilities," 61 *Federal Register* 21540.

Table 8.3-1. Example of Table Summarizing Present and Planned Generating Capacity and Purchases and Sales of Electricity in Context of Electricity Load Forecasts

	Year			
Capacity	**2000**	**2005**	**2010**	**--**
Capacity Needed				
High 25th Percentile Midrange 75th Percentile Low				
Capacity Additions				
Additions, Upratings, Deratings, and Retirements Unit 1 Unit 2 Unit 3... Net Energy and Power Sales (Purchases)				
Firm				
Non-firm				
On-Peak				
Off-Peak				
Net Capacity Needed				
(By scenario)				

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8.4 ASSESSMENT OF NEED FOR POWER

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and assessment of the need for new baseload generating capacity. This review should include an assessment of the timing of the need for the additional capacity.

The scope of the review directed by this plan should include a comparison of baseload capacity with baseload demand, a reserve margin assessment, projected cost of power, a comparison of total capacity in relation to peakload demand, a schedule evaluation, and an ultimate conclusion regarding the need for the electrical-production capability of the proposed facility.

In performing this review, the reviewer may rely on the analysis in the applicant's ER and/or State or regional authorities' or Independent System Operators' (ISOs') analyses concerning the need for power and energy supply alternatives after ensuring that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

Any need for power analysis should also take account of the fact that substantial amounts of electricity are now bought and sold between regions in the country and between utilities in the same region. Such trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 8.2.1 and 8.2.2. Obtain data on power and energy requirements and factors affecting growth of demand.

- ESRP 8.3. Obtain data on power supply.

- ESRPs 9.2.1 and 9.2.2. Provide information to assist in the consideration of alternative sources of energy that might provide the baseload generating capacity.

- ESRPs 10.4.1 and 10.4.2. Provide a summary of the benefit-cost balancing dealing with the consequences of not having sufficient baseload capacity or of adding this capacity too soon.

Data and Information Needs

Affected States and/or regions continue to prepare need-for-power evaluations of proposed energy facilities. The NRC will review the evaluation of the proposed facility and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need-for-power evaluation is found acceptable, no additional independent review by NRC is needed and the analysis can be the basis for ESRPs 8.2 through 8.4.

As part of their analyses of the need for power, States and/or regional authorities normally describe and assess the need for power. These data may be supplemented by information sources such as the Energy Information Administration, FERC, North American Electric Reliability Council, and others.

If an analysis meeting the preceding criteria is not available, the following data or information should be obtained by NRC staff for review of the applicant's need-for-power analysis:

- projected baseload demand from the present to 3 years after initial commercial operation of all proposed units. Prepare a table showing baseload demands, baseload capacities, and resulting deficit or surplus (see Table 8.4-1) and a table showing peakload responsibilities, accredited generating capacities, and resulting reserve margin (see Table 8.4-2).

- reserve margin criteria for the service area. Briefly describe the reserve margin deemed desirable by the staff based on its evaluation of the applicant's analysis and supplementary sources of information.

- the applicant's calculated reserve margins extending from the present to the first 3 years after initial operation of all proposed units

- historical data on installed and actual reserve margins at the time of summer and winter peak hourly demand for the 15 years preceding the date of application

- the relationship between reserve margin (expressed as percent) and system reliability level (expressed as 1 day's outage in 10 years, 5 years, etc.).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the staff's assessment of the need for power are based on the relevant requirements of the following:

- Section 103(b)(1) of the Atomic Energy Act specifies that NRC can only issue licenses for utilization or production facilities whose proposed activities will serve a useful purpose proportionate to the quantities of special nuclear material or source material to be utilized

- 10 CFR 51, Appendix A(4), with respect to discussion of the no-action alternative in NRC environmental impact statements (EISs)

- 10 CFR 51.71(d) with respect to analysis of alternatives

- 10 CFR 51.71(e) with respect to weighing the costs and benefits of the proposed action and reasonable alternatives.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the need for new capacity.

Technical Rationale

The technical rationale for evaluating the applicant's assessment of the need for power is discussed in the following paragraphs:

The Atomic Energy Act states that licenses for a nuclear power plant can only be issued when the plant will serve a useful purpose proportional to the quantities of special nuclear material or source material to be utilized. A demonstration of the need for electricity from the proposed plant is necessary to satisfy the "useful purpose" requirement.

NRC's regulations implementing the National Environmental Policy Act (NEPA) in 10 CFR 51 include Appendix A, containing the format for presentation of material in EISs. Section 4 of Appendix A specifically requires that the no-action alternative be discussed in an NRC EIS. ESRP 8.4 will assist in this analysis.

NRC's regulations implementing NEPA also include 10 CFR 51.71, which specifies the content requirements for draft EISs. It is stated in 10 CFR 51.71(d) that a draft EIS is to include "a preliminary analysis which considers and balances the environmental and other effects of the proposed action and the alternatives available for reducing or avoiding adverse environmental and other effects." In addition to providing input for analysis of the no-action alternative, the review conducted under ESRP 8.4 will aid this analysis by providing as input to ESRP 9.1 information to assist in the consideration of alternative sources of electric energy.

It is stated in 10 CFR 51.71(e) that a draft EIS is to include a preliminary recommendation respecting the proposed action "reached after weighing the costs and benefits of the proposed action and considering reasonable alternatives." The review conducted under ESRP 8.4 will aid this determination by evaluating the need for power and the potential benefits of the proposed action and the alternatives.

III. REVIEW PROCEDURES

If an independent review of need for power is to be conducted by NRC staff in lieu of using a review prepared by affected States and/or regions, the procedures discussed below should be followed. These procedures also may be used by the reviewer as an aid in evaluating forecasts prepared by others. The procedures assume a traditional utility. Industry best practice may evolve in response to deregulation. The reviewer should be aware of, and use, industry best practice where possible.

(1) Calculate baseload demand as that portion of forecasted kilowatt-hour (kWh) sales occurring at loads equal to or less than average load.

(a) Forecasted growth in the relevant region(s) as a range:

- The forecasted growth rates of kWh sales in this analysis should include at least the applicant's mid-range, high, low, 75th percentile, and 25th percentile forecasts, and the forecast ranges developed by the affected State and/or region or NRC staff (ESRP 8.2.1).

- If the range of reasonable forecasts developed or adopted by the staff (the 25th percentile to 75th percentile range) includes the applicant's forecasts of the 25th to 75th percentile range, perform the analysis using the NRC range.

- If the range of relevant regional forecasts developed or adopted by the NRC staff is included in the applicant's 25th percentile to 75th percentile range, perform the analysis using the applicant's range.

- If the two ranges partially overlap or one is lower, use the lower of the two ranges.

(b) In any case, analyze

- reasons for differences between the applicant's forecast and the forecast developed or adopted by the staff

- the implications for baseload demand of the extreme value forecasts.

(2) Analyze the power supply data (e.g., capacity factors, variable costs, redesignations) and estimate the baseload capacity of the system using the evaluation of ESRP 8.3.

(3) Compare the supply of baseload capacity with the demand for baseload capacity for the first 3 years of commercial operation of all proposed units.

(4) Identify the reserve margin[a] requirements currently in acceptance for the service area and identify the organization responsible for establishing this requirement.

(a) Determine if the reserve margin requirements at the time the proposed units are scheduled to begin operation are different from the current reserve margin requirements.

(b) Contact the appropriate regional reliability council, other regional bodies, power pools, and FERC to compare this reserve margin requirement with requirements recommended by these organizations.

(5) Calculate the region's accredited generating capacity (i.e., total installed capacity plus nonfirm purchases and less nonfirm sales) for the period extending from 1 year preceding commercial operation of the proposed first unit to the 3rd year of commercial operation of the proposed last unit.

(6) Calculate peakload[b] responsibility based on the growth rates for peakload demand calculated for ESRP 8.2.1.

(7) For reviews requiring additional staff analysis, calculate peakload responsibility based on forecasted growth rates for peakload demand.

(a) Determine these by contrasting the applicant's projected range of growth rates for system peakload with the range of growth rates developed or adopted by the staff for the system peak.

The same rules for comparison apply as for annual kWh sales:

(a) Reserves are defined in this ESRP as the difference between accredited net generating capacity and peakload responsibility; the reserve margin is this difference divided by the peakload responsibility.

(b) For each growth rate used, calculate system peakload for the relevant years and adjust for firm purchases and sales and interruptible contracts to obtain peakload responsibility.

- If the range of reasonable forecasts developed or adopted by the staff includes the applicant's forecast, the reviewer should perform the analysis using the developed or adopted forecast.

- If the range of forecasts falls totally below the applicant's forecast, the reviewer should use the staff forecasts.

(8) For each estimate of peakload responsibility[a] and for each year under consideration, calculate reserve margin as

$$\text{Reserve Margin} = \frac{\text{Accredited Generating Capacity} - \text{Peakload Responsibility}}{\text{Peakload Responsibility}}$$

Based on the reserve margins and the projections for baseload demand, determine the timespan representing the probable dates when plant capacity will initially be needed.

(9) Prepare an analysis of the costs and benefits of not having sufficient and timely capacity additions and also the costs and benefits of adding capacity too soon.

(a) For these purposes, assume the applicant's proposed date of commercial operation of all proposed units and consider the effects of the load materializing 3 years earlier than this date and 3 years later than this date.

(b) The 6-year timespan may be shifted if conditions specific to the service area suggest this to be appropriate.

Treatment of this subject should include, at a minimum, participation by the socioeconomic and benefit-cost reviewers.

(10) If a need-for-power analysis conducted by or for one or more relevant regions affected by the proposed plant concludes there is a need for new generating capacity, that finding should be given great weight provided that the analysis was systematic, comprehensive, subject to confirmation, and responsive to forecast uncertainty.

If no such analysis is available, determine whether the projected peakload responsibility plus the reserve requirement exceeds the total accredited generating capacity and, absent special circumstances, these findings justify the conclusion that new capacity is warranted.

(a) Peakload responsibility is defined as system load plus firm sales and less firm purchases.

Although this criterion does not show a need for baseload capacity, it does demonstrate a need for new capacity that is independent of type. This criterion, coupled with an affirmative indication that there is a need for baseload capacity, justifies a baseload addition within the timespan determined by the reviewer's forecast analysis.

(11) If these criteria cannot be met, it may still be possible that the proposed facility will be needed on some other basis. The analysis should be summarized in a table similar to Table 8.4-3. Additional considerations include the following:

- the relevant region's need to diversify sources of energy (e.g., using a mix of nuclear fuel and coal for baseload generation)
- the potential to reduce the average cost of electricity to consumers
- the nationwide need to reduce reliance on fossil fuels generally, and imported petroleum in particular
- the case of a significant benefit-cost advantage being associated with plant operation before system demand for the plant capacity develops. (This will require the reviewer's benefit-cost evaluation of the consequences of not having sufficient baseload capacity or of adding this capacity too soon.)

If none of the above criteria can be satisfied, it may be concluded that there is no need for additional baseload generating capability on the scale represented by the applicant's proposal during the timespan considered.

IV. EVALUATION FINDINGS

This section of the environmental impact statement should be planned to document the following: (1) public disclosure of the applicant's forecast of need for the proposed project, (2) a presentation of the staff's analysis of the applicant's forecast, and (3) a presentation of the staff's conclusion of whether additional capacity is needed within the timespan developed by the staff.

The following information should be included in the EIS:

- a table showing baseload demands, baseload capacities, and resulting deficit or surplus (see Table 8.4-1)
- a table showing peakload responsibilities, accredited generating capacities, and resulting reserve margin (see Table 8.4-2)
- a brief description of the reserve margin deemed desirable by the staff based on its evaluation of the applicant's analysis and supplementary sources of information

- the staff's conclusion as to whether additional capacity (represented by the proposed plant) is needed within the timespan developed by the staff

- a tabulation of costs and benefits associated with bringing the proposed plant online as scheduled, but not having the electrical demand materialize as projected.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A(4), "Purpose and need for action."

10 CFR 51.71, "Draft environmental impact statement—contents."

Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq.

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminating Transmission Services by Public Utilities." *Federal Register* 21540.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

Table 8.4-1. Baseload Demand, Capacity, and Capacity Surplus (Deficit)

	Year			
	2000	**2005**	**2010**	**--**
Baseload Demand by Scenario				
High				
25th Percentile				
Midrange				
75th Percentile				
Low				
Baseload Capacity				
Surplus (Deficit)				
High				
25th Percentile				
Midrange				
75th Percentile				
Low				

Table 8.4-2. Peakload Responsibilities, Generating Capacities, and Reserve Margin

Year	Accredited Generating Capacity (MW)	System Peakload Responsibility (MW)			Reserve Margin (% of Peakload Responsibility)		
		25th Percentile Forecast	Midrange Forecast	75th Percentile Forecast	25th Percentile Forecast	Midrange Forecast	75th Percentile Forecast
2000							
2005[a]							
2010							
2015							
•••							

(a) year unit is expected to come online.

Table 8.4-3. Example of Summary Page of Staff Assessment of Need for Power

Forecast Demand Year =	Net Needed Baseline Capacity	Net Capacity Needed for Peak Power	Net Capacity Needed for Source Diversity	Reduction in Average Cost of Power	Amount and Type of Fossil Fuel Displaced	Net Benefit of Early Availability
High						
25th Percentile						
Midrange						
75th Percentile						
Low						
Net Benefit If 3 Years Earlier						
Net Benefit If 3 Years Later						

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9.0 ALTERNATIVES TO THE PROPOSED ACTION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes alternatives to the proposed action. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 9.1 through 9.4.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's alternatives to the proposed action is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 9.1 through 9.4. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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9.1 NO-ACTION ALTERNATIVE

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and summarization of the no-action alternative. The scope of the review directed by this plan includes a determination of the forecast energy consequences if the project is not completed. The depth and extent of the input to the environmental impact statement (EIS) should include a description of the alternative and the expected results from taking no action.

In performing this review, the reviewer may rely on the analysis in the applicant's ER and/or State or regional authorities' analyses concerning the need for power and energy supply alternatives. The reviewer should ensure that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 8.1 through 8.4. Obtain a description of the power system, factors associated with the power demand and supply, and an assessment of the need for power.
- ESRP 9.2.3. Provide an estimate of the energy consequences that would result from no action.
- ESRP 10.4.2. Provide an estimate of energy consequences that would result from no action.

Data and Information Needs

As part of their analyses of the need for power, States and/or regional authorities ordinarily describe and assess the regional power system. The reviewer should receive the analyses from ESRP 8.1 through 8.4 and understand these analyses. No additional data collection by the reviewer will usually be needed. These data may be supplemented by such information sources as the Energy Information Administration, the Federal Energy Regulatory Commission, and the North American Electric Reliability Council.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the no-action alternative is based on the relevant requirements of the following:

- 10 CFR 51, Appendix A to subpart A, with respect to including analysis of alternatives to the proposed action.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to discussing the effect of no action on increasing generating capacity.

Technical Rationale

The technical rationale for evaluating the applicant's no-action alternative is discussed in the following paragraph:

> The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP contributes to the consideration of alternatives by the applicant by addressing the alternative of no action. The results of this review are considered in the assessment of alternative energy sources and systems conducted under ESRP 9.2.3.

III. REVIEW PROCEDURES

The reviewer should establish the validity of the forecast data for the energy consequences expected as a result of not building the proposed facility and taking no alternative actions, such as the development of alternative energy sources, or the use of conservation measures.

IV. EVALUATION FINDINGS

The review conducted under this ESRP should present a concise definition of the no-action alternative and a concise description of the effects of no action. The following is an example of the type of input that would be appropriate for the EIS:

- The no-action alternative is taken here to mean that such factors as the denial of the necessary Federal, State, regional, local, and/or affected Native American tribal agencies permits or financing or some other factor unrelated to the need for power could lead to the applicant's decision not to proceed with the construction and operation of the proposed facility, even though the project is needed.

- Environmental impacts of the no-action alternative are compared with those of other alternatives in this section. The no-action alternative would result in the facility not being built, and no other facility would be built or other strategy implemented to take its place. This would mean that the electrical capacity to be provided by the project would not become available. The no-action alternative also presupposes that no additional conservation measures would be enacted to decrease the amount of electrical capacity that would otherwise be required.

- The most significant regional effect of taking no action would be the power resource loss to the utility(ies) associated with the project. Assuming that a need for the facility exists, the utilities could be forced to (1) implement power-reduction measures such as curtailment of power, (2) attempt to purchase power elsewhere, or (3) begin to plan their own generating facilities. Costs for an identical plant built later could be higher because of inflation.

The EIS should also contain the following:

- the regional forecast data for the total energy consequences expected in the absence of the proposed facility and as the result of taking no further action to increase energy capacity

- a statement that the predicted environmental impacts from the project would not occur at the site if the facility were not built. If other generating sources were built in the future, some of these impacts (air, groundwater, socioeconomic) could eventually occur in other areas.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

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9.2 ENERGY ALTERNATIVES

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the alternatives related to energy. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 9.2.1 through 9.2.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's energy alternatives is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 9.2.1 through 9.2.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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9.2.1 ALTERNATIVES NOT REQUIRING NEW GENERATING CAPACITY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and assessment of the economic and technical feasibility of (1) supplying the projected demand for electrical energy identified in ESRP 8.4 without constructing new generating capacity or (2) initiating energy conservation measures that would avoid the need for the plant. The scope of the review directed by this plan should include consideration of (1) power purchases from other utilities or power generators and reactivation or extended service life of plants within the power system in combinations that should provide a supply alternative to the proposed project and (2) the potential for energy conservation on demand management measures that would be equivalent to the output of the proposed project. Energy sources selected by this review should be compared with the proposed project by the reviewer for ESRP 9.2.3.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or State or regional authorities' analyses concerning the need for power and energy supply alternatives. The reviewer should ensure that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

The guidance in this ESRP is limited because the regulatory environment for electrical generating facilities is changing. Reviewers of issues related to need for power and evaluation of alternatives must know current NRC policy before beginning their review. Deregulation of utilities and open access to power-transmission systems should have a significant impact on the analysis of need for power, on the competition for cheaper power, and on the service area. Because of deregulation in bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and

exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate customers within a utility's traditional service area increasingly is not met by the utility's own generating resources.

Trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open-access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service.

The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. Relevant service area is a situation-specific concept, and it must be defined on a case-by-case basis. Applicants may be power generators rather than a utility; therefore, analysis of existing and projected capacity and alternatives must be sufficiently flexible to accommodate differences in the applicant types and regulatory environments. The concept of "relevant region" is also introduced here to mean an area for which electricity demand forecasts are estimated, such as the Northeast Power Coordinating Council region, that would usually include the relevant service area, but may not if the applicant intends to sell power to a wider geographic area such as the Eastern United States.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 3.7. Obtain a description of the power transmission system from the reviewer for ESRP 3.7.
- ESRPs 8.1 through 8.4. Obtain a description of the power system, factors associated with the power demand and supply, and an assessment of the need for power from the reviewers for ESRPs 8.1 through 8.4.
- ESRP 9.2.3. Provide an estimate of the amount of electrical generating capacity that could be provided without the creation of new generating capacity and the costs associated with providing this capacity.
- ESRP 10.4.3. Provide an estimate of the quantity of electrical generating capacity that would be available without the creation of new generating capacity, the costs of providing the capacity, and the basis for the reviewer's conclusions.

Data and Information Needs

As part of the analysis of the need for power, affected States and/or regions continue to prepare descriptions and assessments of their regional power systems and assessments of alternatives for supply. NRC will review the relevant evaluation and determine if it is (1) systematic, (2) comprehensive,

(3) subject to confirmation, and (4) responsive to forecasting uncertainty. If it is found acceptable, the reviewer may rely heavily on the information. If a suitable analysis is not available, the following data or information should be obtained.[a]

- The administrative structure of the current generating supply system in the relevant regional grid and the applicant's relationship to this structure in terms of current and projected power supply. Full account should be taken of non-discriminatory access rules as promulgated by the FERC.[b]

- The projected regional system reserve margins of relevant electric utilities and other generators should be for a 6-year period starting with the 1st year of commercial operation of the proposed facility.

- The projected peak loads of the electric utilities in the area being served, load duration curve, and baseload for the same 6-year period.

- Transmission intertie capability within the relevant region's plant and between the systems identified in the first bulleted item in this list during the initial years of plant operation.

- A listing of the plants in the relevant service area scheduled for retirement during the period extending from date of application through the 6th year of commercial operation of the proposed project, including existing nuclear power plants within the relevant region that are near the end of their license and are candidates for license renewal. Power plants available for reactivation should also be considered.

- The expected plant generating capacity, projected availability factor, environmental impacts, and operating costs (including capital costs required to put the unit back on line) of any plants with the potential for reactivation or extended operation.

- The potential for energy conservation within the relevant service area (from ESRP 8.2.2.2).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of alternatives not requiring new generating capacity are based on the relevant requirements of the following:

(a) Most of these data are available from sources such as the Energy Information Administration, FERC, North American Electric Reliability Council, and others.

(b) Electric Utilities (Federal Power Act); Promoting Wholesale Competition Through Open-Access Nondiscriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities; Final Rule and Proposed Rule. 61 *Federal Register* 21540-21738 (May 10, 1996).

- 10 CFR 51, Appendix A to Subpart A, with respect to including analysis of alternatives to the proposed action.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the analysis of alternatives to adding new generating capacity.

Technical Rationale

The technical rationale for evaluating the applicant's alternatives not requiring new generating capacity is discussed in the following paragraph:

> The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP contributes to the consideration of alternatives by the applicant by addressing alternatives that do not involve the addition of power generation capacity. The results of this review should be considered in the assessment of alternative energy sources and systems conducted under ESRP 9.2.3.

III. REVIEW PROCEDURES

The analysis includes two separate evaluations: the first of power purchases and reactivation and the second of energy efficiency. Projections by Federal, State, regional, local, and affected Native American tribal agencies energy planners may be the most useful source of capacity and demand information available. Consult current NRC policies regarding these evaluations for alternative analyses.

The extent of this analysis should be determined by the amount and cost of capacity available through combinations of purchases of power and reactivating or extending the service life of plants within the relevant regional system. To make this determination, the reviewer should conduct a brief initial analysis following the procedures in the following subsections to identify the probable amount of electrical generating capacity available.

Power Purchases

The reviewer should determine if excess generating capacity (capacity beyond reserve margin requirements) will be available for extended periods of time from other sources. The time period to be considered for determining this availability should cover a 6-year period starting with the expected first year of commercial operation of the proposed project. Excess generating capacity of these utilities and/or systems should be summed and compared with the capacity need established in ESRP 8.4.

If sufficient excess capacity has been identified to warrant continuation of this review, the reviewer should do the following:

(1) Determine if adequate transmission line interties exist for the efficient transfer of this power.

(2) Determine the administrative structure of the current generating supply system in the relevant regional grid and the applicant's relationship to this structure in terms of current and projected power supply. Full account should be taken of nondiscriminatory access rules as promulgated by the FERC.

(3) Consult with the reviewer for ESRP 3.7 to identify existing transmission lines and corridors within the region.

(4) If transmission lines and interties are not available, make general estimates of the costs[a] to construct and maintain such lines and estimates of the environmental impacts associated with their construction and maintenance.

Plant Reactivation or Extended Service Life

To review the relevant regional (e.g., power pool, power marketing area, major utility service area) inventory of the available generating plants, the reviewer should do the following:

(1) Identify plants now deactivated but potentially operable.

(2) Identify plants scheduled for retirement during the period extending from the date of application through the 6th year of commercial operation of the proposed project.

In considering alternatives, the reviewer should be guided by FERC practice to define relevant markets as those utilities directly interconnected to the applicant (first-tier markets). For each first-tier market, FERC considers all utilities interconnected to the first-tier utility and all utilities interconnected to the applicant as competitors in that relevant market. Thus, the competitors usually are assumed to include the second-tier utilities that can reach the market by virtue of the applicant's open-access transmission tariff. FERC admits that the open-access rule may lead to consideration of an area broader in scope than the first-tier and second-tier markets currently considered. However, evidence of transmission constraints may circumscribe the scope of the relevant market. FERC permits applicants and intervenors to argue that the market is broader or narrower than that offered by second-tier utilities. The argument must be more than open access and involves transmission constraints and cumulative transmission costs.

(a) The cost analyses should be made on the basis of data available in references or that can readily be supplied by the applicant. Costs should include environmental costs.

When sufficient capacity is identified to warrant further analysis,[a] the reviewer should review the estimate of the environmental and operating costs associated with the use of these plants. Factors to be considered in preparing these cost estimates should include the

- capital costs needed to reactivate retired plants and to upgrade existing plants, when necessary, to comply with current standards
- operating costs, including costs associated with meeting current environmental standards (these costs should be adjusted to account for reduced availability factors where applicable)
- environmental costs, including the environmental impacts associated with alternative-energy sources.

Conservation (Energy Efficiency)

The reviewer's analysis of conservation (increased energy efficiency) as an alternative to construction of the proposed plant should be based on the analysis and evaluation of conservation and substitution received from the reviewer for ESRP 8.2.2.2. Except for unusual circumstances, no additional review should be required to complete this portion of this ESRP, since the reviewers for ESRP 8.2.2.2 and 8.4, in the process of analyzing and evaluating the need for the plant, should make a determination that conservation is or is not a practical alternative to the proposed plant. The reviewer should consult with and assist the reviewer for ESRP 8.2.2.2 in analyzing the effects of conservation on the need for the plant and to prepare data for inclusion in this section of the EIS.

The reviewer should review the relevant regional (e.g., power pool, power marketing area, major utility service area) summation of the total amount of alternative electrical generating capacity available through a combination of purchased power and the reactivation and extended service life of plants within the regional system. If this combined capacity is insufficient to meet the capacity needs through the 6th year of commercial operation of the proposed project, the reviewer may conclude that this alternative is not feasible. Where sufficient capacity is available, the reviewer should consider whether there are any factors unique to the relevant regional system that could prevent the reactivation or extended service life of existing units or the purchase of power from other systems.

The reviewer should ensure that cost data associated with this alternative, including purchases of power, transmission line costs, capital/operating costs and environmental costs of reactivated and extended service life plants, are available and accurate and can be compared with the costs of the proposed project. These cost data should be used by the reviewer for ESRP 9.2.3. Where sufficient electrical generating capacity is available to meet the need established by the reviewers for ESRP Chapter 8.0, and the costs of the alternative are reasonable when compared to costs of the proposed project, the reviewer of ESRP 9.2.1 should provide this assessment to the reviewer of ESRP 9.2.3. However, when costs of this

(a) The reviewer may want to consider the plant-availability factor at this point. The expected availability factors through the 6th year of commercial operation of the proposed project should be used for this analysis.

alternative are significantly greater than costs of the proposed project, the reviewer, after consulting with the reviewers for ESRP 10.4, may conclude that the alternative is not practical.

The reviewer should ensure that the reviewer for ESRP 8.4 has considered the effects of conservation in determining (1) system peakload responsibility plus reserve requirement, (2) the need for additional baseload capacity, and (3) costs of equipment or education to implement the conservation measures. When this determination has been made, the reviewer should adopt the conclusions of the reviewer for ESRP 8.4 as they relate to conservation as an alternative to the proposed plant.

When the reviewer has determined that the alternatives of conservation, power plant reactivation and life extension, and power import have been adequately described and explored, this information should be included in the environmental impact statement (EIS) and communicated to the reviewer of ESRP 9.2.3 for analysis of alternatives.

IV. EVALUATION FINDINGS

The depth and extent of the input to the EIS should be governed by the analyses required to draw the final conclusion for this section. The input should include the basis for rejecting or accepting the alternative and supporting data such as (1) the amount of (or lack of) excess generating capacity available for purchase, (2) the plants within the regional system, if any, available for reactivation or extended service life and their operating costs and availability factors, and (3) the effects of conservation on reducing the need for electrical generating capacity.

The characteristics of the alternatives should be described in sufficient detail that a decision can be reached regarding environmental impacts. The NRC staff evaluation supports concluding statements of the following type to be included in the EIS:

> The staff reviewed the available information and concluded that the issues have been covered in sufficient detail for staff analysis of alternatives not requiring new generating capacity.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminating Transmission Services by Public Utilities," 61 *Federal Register* 21540.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

9.2.2 ALTERNATIVES REQUIRING NEW GENERATING CAPACITY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and review of alternative sources of energy that could reasonably be expected to meet the demand from both a load and economic standpoint for additional generating capacity determined for the proposed project. Energy sources selected by this review will be compared with the proposed project by the reviewer for ESRP 9.2.3. The scope of the review directed by this plan will be governed by consideration of national policy, by site- and region-specific factors, and by the extent to which the energy sources may be considered as commercially exploitable. Within this scope, the reviewer should determine the current and projected status of (1) alternatives not yet commercially available, (2) fossil fuels, taking into account national policy regarding their use as fuels, and (3) alternatives uniquely available within the region (e.g., hydropower).

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or State or regional authorities' analyses concerning the need for power and energy supply alternatives. The reviewer should ensure that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

The guidance in this ESRP is limited because the regulatory environment for electrical generating facilities is changing. Reviewers of issues related to need for power and evaluation of alternatives must know current NRC policy before beginning their review. Deregulation of utilities and open access to power-transmission systems should have a significant impact on the analysis of need for power, on the competition for cheaper power, and on the service area. Because of deregulation in bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and

exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate customers within a utility's traditional service area increasingly is not met by the utility's own generating resources.

Trading of electricity will be further facilitated by the Federal Energy Regulatory Commission's (FERC's) final rule (61 FR 21540) requiring all public utilities that own, control, or operate facilities used for transmitting electric energy in interstate commerce to have on file open-access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service.

The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. Relevant service area is a situation-specific concept, and it must be defined on a case-by-case basis. Applicants may be power generators rather than a utility; therefore, analysis of existing and projected capacity and alternatives must be sufficiently flexible to accommodate differences in the applicant types and regulatory environments. The concept of "relevant region" is also introduced here to mean an area for which electricity-demand forecasts are done, such as the Northeast Power Coordinating Council region, that would usually include the relevant service area.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 8.1-8.4. Obtain a description of the power system, factors associated with the power demand and supply, and an assessment of the need for power.

- ESRP 9.2.3. For each alternative established as competitive, provide the reviewer with a description of the energy source/plant combination. This should include the basis for the staff's conclusion and sufficient design/performance data to permit the subsequent comparison of the alternative with the proposed project.

Data and Information Needs

The kinds of data and information needed will be affected by site and regional factors as they concern availability of the alternative energy sources, and the degree of detail should be modified according to the technological status of the alternatives or combinations of alternatives. If an analysis meeting the preceding criteria is not available, the following data or information should be obtained:

- For alternatives that have not yet achieved commercial acceptance, U.S. Department of Energy (DOE) research, development, and demonstration/commercialization schedules and projected capability as a source of central station power. Information on many of these technologies is available from DOE's Internet site, currently listed as http://www.doe.gov/.

- For nonrenewable fuels (coal, natural gas, and petroleum fuels), the fuel quality, availability to the applicant, rate of consumption estimates, potential environmental restrictions and impacts, and emissions and definition of U.S. national policy, if any, with respect to new uses of these fuels.

- For renewable fuels (wind, geothermal, hydroelectric, wood waste and municipal solid waste, energy crops, and solar), availability to the applicant, quantities needed, potential environmental restrictions, amount of land that would be occupied, and amount of the fuel available.

  For these alternatives, the reviewer should obtain the extent of the resource, environmental restrictions and impacts, licensing constraints, status of commercialization, and engineering problems associated with each source (from the ER and consultation with local resource agencies).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of alternatives requiring new generating capacity are based on the relevant requirements of the following:

- 10 CFR 51.71(a) and 10 CFR 51.45(b)(3) with respect to the need to discuss alternatives to the proposed action

- 10 CFR 51, Appendix A to Subpart A, discussing alternatives to the proposed action

- 10 CFR 51.75 with respect to construction-permit contents that provide alternatives, including the proposed action, need to be part of the construction permit.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the analysis of alternatives requiring new generating capacity.

Technical Rationale

The technical rationale for evaluating the applicant's alternatives requiring new generating capacity is discussed in the following paragraph:

The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP section contributes to the consideration of alternatives by addressing alternatives that involve the addition of power generation capacity. The results of this review are considered in the assessment of alternative energy sources and systems conducted under ESRP 9.2.3.

III. REVIEW PROCEDURES

The reviewer should review the alternative energy sources and combinations of sources available to the applicant, and categorize them as either competitive or noncompetitive with the proposed project.

(1) For competitive alternatives, the reviewer should ensure that the energy source or system meet the following criteria:

- The energy conversion technology should be developed, proven, and available in the relevant region.[a]
- The alternative energy source should provide generating capacity equivalent to the capacity need established by the reviewer of ESRP 8.4.
- The capacity should be available within the timeframe determined for the proposed project.
- Use of the energy source is in accord with national policy goals for energy use.
- Federal, State, or local regulations do not prohibit or restrict the use of the energy source.
- There are no unusual environmental impacts or exceptional costs associated with the energy source that would make it impractical.
- The reviewer should ensure that the following energy sources have been considered by the applicant:
  - wind
  - geothermal
  - petroleum liquids
  - natural gas
  - hydropower
  - advanced nuclear
  - municipal solid wastes
  - biomass
  - coal
  - photovoltaic cells
  - solar thermal power
  - wood waste
  - energy crops

(a) Current reports on specific technologies may be identified from the DOE's program offices' internet sites (http://www.doe.gov).

- advanced light-water reactor
- other advanced systems (e.g. fuel cells, synthetic fuels, etc.)

- The reviewer should ensure that all alternative energy sources available have been evaluated using the criteria listed above to determine if the alternatives can be considered competitive with the proposed project.

(2) For noncompetitive alternatives, the reviewer should ensure that the statements dismissing these alternatives are appropriately referenced, applied to the relevant regional system, and that the reasons for rejecting these alternatives have been provided.

(3) For alternative energy sources, the reviewer should evaluate the applicant's or regional authority's analysis of each energy source to determine that it describes the source plant combination in sufficient detail to enable the reviewer of ESRP 9.2.3 to compare the environmental and social costs of this alternative with the proposed project. Specific analytical procedures should depend on the alternative. The reviewer should evaluate the analysis procedure in consultation with the reviewers of ESRP 9.2.3 (for analysis requirements) and ESRP Chapter 2.0 (for environmental descriptions and socioeconomic data).

(4) For the alternatives considered viable, the reviewer should ensure that there are suitable sites for an alternative plant and should determine the general characteristics of such a site plant combination. The results of this analysis should be used by the reviewer of ESRP 9.2.3 in determining the costs (environmental, health, dollar, etc.) of the alternative and comparing them with costs of the proposed project. Based on an appropriate site (this may include the proposed nuclear plant site) and the energy sources identified, the reviewer should consider the following:

- distance from the fuel sources to the plant, probable transportation means, and mileages for each transportation means

- average daily fuel requirements based on the installed capacity need determined by the reviewer for ESRP 8.4 and the heat content

- need for fuel pretreatment (e.g., washing), if any, including the volumes of materials (water) required, the quantities of wastes produced, and means of waste disposal. Also include estimated effects of fuel source preparation on fuel characteristics, quantities of water required, and quantities of wastes produced.

- in the case of coal or other solids as the preferred alternative to the proposed project, need for combustion-product solid waste disposal, including the quantities of wastes produced and disposal methods and locations for deposition of solid waste

- need for flue-gas desulfurization, the process to be used, and (on an average daily basis), the raw material inputs and byproduct and/or waste product outputs and means of waste disposal

- average daily atmospheric releases of carbon dioxide (CO_2) and pollutants of concern regulated under the Clean Air Act (including total suspended particulates [TSP], sulfur oxides [So_x], and nitrogen oxides [NO_x].

(5) For alternatives that have been determined to be competitive, the reviewer should ensure that sufficient data are available to permit the reviewer of ESRP 9.2.3 to compare the environmental costs of these alternatives with costs of the proposed project.

(6) For each alternative established as noncompetitive, a brief statement should be prepared describing or identifying the alternative and the basis for the staff's conclusion that it was noncompetitive.

IV. EVALUATION FINDINGS

Input to the environmental impact statement (EIS) review should be directed toward accomplishing the following objectives: (1) public disclosure of the alternative energy sources considered, (2) presentation of the basis for the staff analysis, and (3) presentation of staff conclusions for each alternative energy source considered.

The depth and extent of the input to the EIS should be governed by the alternatives or combination of alternatives that are found to be economically viable. The characteristics of the alternatives should be described in sufficient detail that a decision can be reached regarding environmental impacts. The NRC staff evaluation should support concluding statements of the following type to be included in the EIS:

> The staff reviewed the available information and concluded that the issues have been covered in sufficient detail for staff analysis of alternatives requiring new generating capacity.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

Clean Air Act Amendments of 1977, as amended, 41 USC 7401 et seq.

Federal Energy Regulation Commission. 1996. "Promoting Wholesale Competition Through Open-Access Nondiscriminating Transmission Services by Public Utilities," 61 *Federal Register* 21540.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

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OFFICE OF NUCLEAR REACTOR REGULATION

9.2.3 ASSESSMENT OF ALTERNATIVE ENERGY SOURCES AND SYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis, evaluation, and comparison of alternative means of generating electricity with the proposed project. Based on environmental conditions, the reviewer should determine if one or more of the alternatives can be expected to (1) provide an appreciable reduction in overall environmental impact, or (2) offer solutions to potential adverse impacts predicted for the proposed project for which no mitigation procedure could be identified. When such environmentally preferable alternatives are identified, the reviewer should compare economic costs of these alternatives with the proposed project to determine if any alternative is preferred (superior) to the proposed project. When superior alternatives are identified, the reviewer should recommend consideration of (1) adoption of the alternative by the applicant and (2) denial of the construction permit.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or State or regional authorities' analyses concerning the need for power and energy supply alternatives. The reviewer should ensure that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

The scope of the review directed by this plan should be limited to those alternative energy sources and systems that the reviewers of ESRP 9.2.1 and 9.2.2 have identified as available to the applicant and potentially competitive with the proposed project.

This review should accomplish the following objectives: (1) description of the alternative energy sources and systems that were considered and the 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 analysis of the alternatives is a two-step process: (1) comparing environmental costs to health effects and (2) considering the economic costs.

- Environmental Costs—The reviewer should review the alternatives judged environmentally preferable, equivalent, or inferior to the proposed project. A table should be prepared to present the staff's comparison of these potential alternatives (see Table 9.2.3-1). The review should describe any severe environmental impacts that cannot be mitigated, as well as any unusual environmental costs (e.g., land use) required by the proposed project or by an alternative.

- Health Effects—NUREG-0332, *Potential Health and Environmental Effects Attributable to the Nuclear and Coal Fuel Cycle* (NRC 1987), as modified and updated, should be the basis for the health-effects analysis summarized in this section.

- Economic Costs—When the reviewer has concluded that an alternative is environmentally preferable and should be considered as the preferred energy source or system, the reviewer should select tables from those given in Tables 9.2.3-3 through 9.2.3-14 to describe economic costs. A summary table similar to Table 9.2.3-12 should be presented when an environmentally preferable alternative has been identified. Sufficient additional narrative detail should also be included in the input to justify the alternative on an environmental and economic cost basis.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 4 and 5. Obtain information from these sections regarding measures and controls to limit adverse impacts for the proposed project. This information should be used as a baseline when comparing alternative energy sources and systems.

- ESRPs 9.2.1 and 9.2.2. Obtain information from these sections to assist in the development of cost and impact data that can be compared with the proposed project.

- ESRP 10.4.3. Obtain input from the reviewer of this ESRP during the evaluation of the economic costs of any alternative identified as being environmentally preferable to the proposed project.

- Interface with the Environmental Project Manager (EPM). Obtain input from the EPM when an alternative appears to meet regulatory requirements with less severe impacts than the proposed action. If an environmentally preferable alternative is more costly or provides fewer benefits, obtain input from the EPM to decide whether this alternative should be considered further.

Data and Information Needs

The kinds of data and information needed will be governed by the nature of the alternative energy sources and systems selected by the reviewers of ESRPs 9.2.1 and 9.2.2. The following data or information should be obtained:

- a summary of the predicted environmental impacts of construction and operation of the proposed project(s), including both environmental and socioeconomic impacts (from reviewers for ESRP Chapters 4.0 and 5.0)

- a summary of the predicted environmental impacts of the construction and operation of each potential alternative or combination of alternatives identified by the reviewers of ESRPs 9.2.1 and 9.2.2

- data needed to update the health effects analysis contained in NUREG-0332 (from the general literature).

The following data and information should be obtained when alternatives or combination of alternatives identified by the reviewers for ESRPs 9.2.1 and 9.2.2 have been determined to be environmentally preferable to the proposed project:

- capital cost estimates for the proposed project and for each alternative in the format outlined in Table 9.2.3-3

- decommissioning cost for the proposed project and for each alternative (from the ER and ESRP 5.9) (see Table 9.2.3-13)

- where relevant, the fixed charge rate for the utility or consortium of utilities as outlined in Table 9.2.3-4 (from the ER)

- fuel cost estimates at time of application for the proposed project and for other alternatives, as shown in Table 9.2.3-5 (from the ER)

- the operation and maintenance costs estimates (fixed component and variable component) at time of application for the proposed project and each alternative (from the ER) (see Table 9.2.3-9)

- escalation rates from date of application through plant lifetime (30-year life) for the components of operation and maintenance and fuel for the proposed project and each alternative (from the ER). The 30-year life assumption made throughout this ESRP should be modified to conform with current practice when an environmental review is performed.

- discount rate for the proposed project and each alternative (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of alternatives requiring new generating capacity are based on the relevant requirements of the following:

- 40 CFR 1502.14 with respect to "alternatives including the proposed action"

- 10 CFR 51.71(a) referring to 10 CFR 51.45(a)(3) with respect to contents of the ER and the need to discuss alternatives

- 10 CFR 51, Appendix A, discussing alternatives to the proposed action

- 10 CFR 51.75 referring to 10 CFR 51.71 for construction permit contents that provide alternatives, including the proposed action, need to be part of the construction permit.

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the analysis of alternative energy sources.

Technical Rationale

The technical rationale for evaluating the applicant's assessment of alternative energy sources and systems is discussed in the following paragraphs:

The NRC's environmental protection regulations (10 CFR 51) implementing the NEPA require that the NRC consider all reasonable alternatives to a proposed action before acting on a proposal. This section provides a framework for evaluating alternatives based on overall environmental impact, potential adverse impacts, and costs if an alternative is found to have fewer impacts than the proposed project.

III. REVIEW PROCEDURES

The analysis of alternatives is a two-step process: (1) comparing environmental costs and health effects and (2) considering the economic costs. To accomplish this, the reviewer should

(1) Compare environmental costs and health effects for the proposed project and each alternative. For some costs, a range of costs may be preferable to a point value, particularly when there is some uncertainty in the data. To the extent practical, the analysis should be made with the objective of presenting the cost comparisons in tabular form.

(2) When environmentally preferable alternatives have been identified, consider the economic costs of any such alternative. This analysis should be done in consultation with appropriate ESRP 10.4 reviewers. Assistance from these reviewers will be needed to establish the economic-cost data that should be used to develop a benefit-cost comparison with the baseline proposed project.

(3) Compile a tabular summary of the plant and fuel system characteristics of both the proposed plant and the alternatives with which it should be compared. This summary should provide the basic data from which the subsequent comparison analyses should be made. A sample format for this table is given as Table 9.2.3-1.

The environmental impacts are categorized as

(a) land use
(b) water use
(c) releases to the atmosphere
(d) releases to water
(e) fuel cycle consequences
(f) social and economic effects (including environmental justice).

(1) Environmental Analysis—The reviewer's comparative analyses of environmental costs (impacts) of the proposed project and the identified alternatives should be based on a review of the consumptive/preemptive use of land and water, on plant releases to the atmosphere and to water, on fuel consumption and waste disposal (including need for desulfurization), and on social/aesthetic impacts, including environmental justice, contained in ESRPs 5.8.1 through 5.8.3. The reviewer should develop this analysis by preparing an environmental cost comparison similar to that shown in Table 9.2.3-1. Instructions for the elements of this table are as follows:

(a) Land Use

- Do not include land use associated with the mining of fuel.
- "Total station area" for the nuclear plant should be either the station (sites) area or the exclusion area, whichever is larger.
- Fuel storage should be based on a prudent supply stockpile.

- Waste storage should be for a 30-year plant lifetime. The reviewer should determine land requirements for waste materials on the basis of data established in the fuel cycle effects review. The reviewer should use NUREG-0116, *Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle* (NRC 1976) to determine nuclear waste disposal land requirements.

- Determine electrical and natural gas transmission corridor and access road land-use requirements for new construction only.

(b) Water Use

- Determine water use on the basis of the likely maximum plant capacity factor.

- Water use should include cooling water, plant system water, sanitary waste water, fuel pretreatment water, and flue gas desulfurization (FGD) water.

- Consumption should include water lost by evaporation and drift, consumption with fuel, in the FGD process, or returned to other than the water body from which it was withdrawn.

- Physical impacts should include changes in stream flows, impacts to navigation, impacts to surface-water body users, or similar type impacts.

(c) Releases to the Atmosphere

- Determine atmospheric releases on the basis of a likely maximum plant capacity factor.

- For thermal plants, use either staff verified data as supplied by the applicant, or staff calculated values that will meet applicable Federal, State, regional, local, or affected Native American tribal regulations.

(d) Releases to Water

- Determine releases to water on the basis of a likely maximum plant capacity factor.

- Assume that releases are to surface-water bodies unless otherwise proposed.

(e) Fuel Cycle Consequences

- Base fuel consumption on a likely maximum plant capacity factor.

- Base nuclear fuel consumption on U_3O_8.

- Report nuclear wastes (both high level and low level) in the "ash" category.

- Determine fuel and waste transportation in terms of rail cars/year for solid fuels and truckloads/year for nuclear. Gaseous and liquid fuels should be assumed to be supplied by pipeline.

(f) Social and Economic Effects

- Both construction and plant operation should consider physical effects, such as noise, drift, fogging/icing, and effluent (gaseous and particulate) effects.

- Both plant construction and operations comparison should consider community impacts (e.g., labor market, housing, community services, etc.) and environmental justice considerations identified in ESRP 5.8.3.

Other Effects

- When adverse impacts of construction or operation have been predicted for the proposed project, the reviewer should list these practices and/or operations and their impacts and should estimate the corresponding levels of impact for the alternative energy sources. Similarly, when the reviewer can predict potential adverse impacts attributable to the alternative energy sources, the causes and impacts should be listed and compared with the corresponding impacts of the proposed project.

(2) Health-Effects Analysis—NUREG-0332 as updated presents a comparative analysis and evaluation of health effects attributable to coal and nuclear fuel cycle alternatives. This analysis has been prepared as generic supplemental material to the analysis in ESRP 5.3.4, suitable for inclusion in the staff's environmental statements. Options involving energy conservation may have to consider effects on indoor air quality.

The reviewer's analysis of health effects should consist of a review of the material given in NUREG-0332 and the ER to establish applicability of this material to the proposed project and any alternative, and to incorporate any updated information to this statement as provided by the EPM. Unless otherwise directed, the analysis and evaluation should be prepared for inclusion in the environmental impact statement (EIS).

(3) Economic Analyses—The economic cost data to be analyzed are the estimated costs of supplying electrical energy services over the expected life of the proposed project. The data should span 30 years unless there are unique factors that apply to the specific alternatives under review. In the case of options involving generation, the 30-year levelized cost should be analyzed at appropriate plant capacity factors. The cost comparison between uranium and the alternative fuel should be developed in a tabular form as shown in Table 9.2.3-2. The reviewer should review the applicant's cost calculations and ensure that they are reasonable. The other tables provided in this ESRP include worksheets that can assist in this evaluation.

IV. EVALUATION FINDINGS

The reviewer should ensure that each alternative energy source and system considered 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 is environmentally preferable, equivalent, or inferior to the proposed project. For those alternatives or combination of alternatives determined to be environmentally preferable, the reviewer should ensure that economic-cost data are available in sufficient detail to enable the reviewer to conduct benefit-cost balancing and comparisons with the proposed project leading to final staff recommendations. The reviewer should also ensure that all comparisons are made on the basis of the proposed project as supplemented with those measures and controls to limit adverse impacts that are proposed by the applicant or identified by the staff. For those alternatives eliminated from consideration, the reviewer should ensure that adequate documented justification for this action has been prepared.

(1) The initial step in the evaluation of alternative energy sources and systems should be to categorize these systems as environmentally preferable, equivalent, or inferior to the proposed project. The following criteria should be applied to this evaluation:

- When the reviewer determines that the proposed project (with mitigation measures, if necessary) will have no unavoidable adverse impacts and will comply with applicable Federal, State, regional, local, and affected Native American tribal regulations, the reviewer should conclude that there can be no environmentally preferable alternatives. When this conclusion is reached, the reviewer should evaluate the alternatives to identify those that may be considered environmentally equivalent. For this condition, environmental equivalence means that an alternative should have no unavoidable adverse impacts and meet applicable regulatory requirements. Alternatives having unavoidable adverse environmental impacts or that do not meet regulatory requirements should be judged environmentally inferior to the proposed project under these conditions.

- When the reviewer determines that the proposed project will meet regulatory requirements, but is predicted to have unavoidable adverse environmental impacts, the reviewer should evaluate the identified alternative systems for potential environmental preference to the proposed system. The scope and extent of this evaluation should depend on the nature and magnitude of the proposed project's environmental impacts and may lead to an environmental review for the alternatives following the analysis and evaluation procedures of the appropriate ESRP Chapters 4.0 and 5.0. The following criteria apply to this evaluation:

  - Environmental preference will be established when an alternative can be shown to have no unavoidable adverse impacts and will meet regulatory requirements.

  - 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 project. Determination of environmental

preference under these conditions should lead to consultation with the EPM and the appropriate reviewers of ESRP Chapters 4.0 and 5.0. This consultation should result in a joint determination of the status of any such alternative.

- 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 project.

- Environmental inferiority will be established when an alternative can be shown to have unavoidable adverse impacts more severe in both nature and magnitude than those of the proposed project, or the alternative will not comply with applicable Federal, State, regional, local, and affected Native American tribal regulations and affected Native American tribal requirements.

(2) When the reviewer determines that there are environmentally preferable alternatives to the proposed project, the reviewer should conduct those portions of the analysis instructions of this ESRP that deal with the economic costs of the alternative energy sources and systems. The reviewer should evaluate that portion of the analysis procedure as follows:

- When environmentally preferable alternative energy sources and systems have been identified, ensure that economic-cost data have been developed for the alternatives and that these data are adequate for a benefit-cost balance and comparison with the proposed project. This portion of the evaluation procedure should be conducted with the assistance of appropriate ESRP 10.4 reviewers. Complete the economic analysis portion of this ESRP, and balance and compare benefits and costs of the environmentally preferable alternative(s) with those of the proposed project.

- When an environmentally preferable alternative can be shown to have the same benefits as the proposed project with comparable reliability and at the same or lesser economic costs, provide this finding to the reviewer for ESRP 10.4.3. For those cases where benefits of the alternative are less or where economic costs are greater than those of the proposed project, consult the EPM and with appropriate ESRP Chapter 4.0 and 5.0 reviewers. If this conclusion establishes that the benefit-cost balances of such alternatives are no more than equivalent to the proposed project, they should not be considered further. When alternatives have significantly decreased benefits or increased economic costs, they should be rejected for any further consideration as alternatives.

For a review related to combined permit (CP) and combined license (COL), the reviewer verifies that sufficient information has been provided and that NRC staff evaluation supports concluding statements of the following type to be included in the EIS:

The staff reviewed the available information on alternatives compared to the proposed project. Based on this review, the staff concludes that the information supports the proposed project.

If the information on alternatives indicates that one is superior to the proposed project, a statement similar to the following should be included:

> The staff reviewed the information provided on the alternatives presented by the applicant. Based on this review, the staff concludes that the information does not provide an adequate basis for deciding to support the proposed project. The staff finds that .... is a reasonable alternative on the basis of ....

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

40 CFR 1502.14, "Environmental impact statement."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation (NRC/NRR). 1987. *Potential Health and Environmental Effects Attributable to the Nuclear and Coal Fuel Cycle*. NUREG-0332, Washington, D.C.

U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards (NRC/NMSS). 1976. *Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*. NUREG-0116, Washington, D.C.

Table 9.2.3-1. Environmental Cost and Health Effects Comparisons
(Environmental Preference Screen)

Category Alternatives	Nuclear	Coal	(Others)
Land Use (preferred, equivalent, inferior) Station (total area) Facilities Ponds Fuel storage Waste storage or disposal Waste disposal, offsite Transmission corridors Access roads or other Offsite facilities			
Water Use (preferred, equivalent, inferior) Withdrawal rate (m^3/sec) Consumption (m^3/sec) Return rate (m^3/sec) Physical impacts			
Releases to Atmosphere (preferred, equivalent, inferior) TSP (kg/hr) SO_x (kg/hr) NO_x (kg/hr) VOC (kg/hr) CO_2 (kg/hr) Radioactive material (Ci/yr)			
Releases to Water (preferred, equivalent, inferior) Cooling-system chemicals (kg/hr) Fuel-treatment chemicals (kg/hr) FGD chemicals (kg/hr) Radioactive material (Ci/yr)			

Table 9.2.3-1. (contd)

Category Alternatives	Nuclear	Coal	(Others)
Fuel Cycle (preferred, equivalent, inferior) Fuel consumed (kg/hr) FGD materials (kg/hr) Ash (kg/hr) Fuel transportation Waste material Solid waste (railcars/yr) Nuclear wastes (truckloads/yr)			
Social Effects (preferred, equivalent, inferior) Construction Physical effects (list and quantify) Community impacts (list and quantify) Transportation Aesthetics Other Operations Physical effects (list and quantify) Community impacts (list and quantify) Transportation Aesthetics Other			
Health Effects (preferred, equivalent, inferior)			
Overall Environmental Preference (preferable, equivalent, inferior)			

Table 9.2.3-2. Evaluation of Alternatives

Categorical Alternatives	Nuclear	Coal	(Others)
Environmental preference (preferred, equivalent, inferior)			
Economic cost			
Annualized capital cost (mills/kWh) Operations and maintenance cost (mills/kWh)			
Total cost			

Table 9.2.3-3. Cost Information for Nuclear and Alternative Power Generation Methods

1. Interest during construction ____ %/year, ____ compound rate	5. Escalation rates Purchased equipment ____ %/year Site labor ____ %/year Materials ____ %/year Composite escalation rate ____ %/year
2. Length of construction workweek ____ hours/week	6. Month & year that NSSS ordered _____
3. Estimated site labor requirement ____ man-hours/kWe	
4. Average site labor pay rate (including fringe benefits) effective at month and year of NSSS order ____ $/hour	

7. Power Station Cost Estimate as of date ($M/yr)[a]

Direct Costs	Unit 1	Unit 2	Indirect Costs	Unit 1	Unit 2
a. Land and land rights			a. Construction facilities, equipment, and services		
b. Structures and site facilities			b. Engineering and construction management services		
c. Reactor (boiler) plant equipment			c. Other costs		
d. Turbine plant equipment, not including heat rejection systems			d. Interest during construction (@ _____%/year)		
e. Heat-rejection system			Escalation Escalation during construction (@ _____%/year)		
f. Electric-plant equipment			Total Cost Total Station Cost, @ Start of Commercial Operation Date		
g. Miscellaneous equipment					
h. Spare-parts allowance					
i. Contingency allowance					
Subtotal					

(a) Cost components of nuclear stations to be included in each category listed under direct and indirect costs in Part 7 above are described in "Guide for Economic Evaluation of Nuclear Reactor Plant Design." U.S. Atomic Energy Commission, NUS-531, Appendix B, available from National Technical Information Service, Springfield, Virginia 22161.

Table 9.2.3-4. Fixed-Charge Rates for Electric Utilities (percent)

Component	Public Owned	Investor-Owned
Interest or Return on Investment[a]		
Depreciation (30 yr. S.F.)[b]		
Interim Replacements		
Property Insurance		
Federal Income Taxes		
State and Local Taxes		
Total Fixed-Charge Rate		

(a) Composition of financing should be shown as:

	Amount of Financing (%)	Interest or rate of return (%)
Bonds	_____	_____
Preferred Stock	_____	_____
Common Stock	_____	_____
Composite cost of money	_____	_____

(b) The sinking fund (S.F.) rate in percent is equal to $\frac{i \cdot 100}{(1+i)^n - 1}$

where i is the composite cost of money and n is the plant life, normally 30 years.

Table 9.2.3-5. Material and Service Unit Costs, for Fuel Supply

(Year) Dollars	
Fuel Supply	Cost, $
Coal	
Low Sulfur, _____J/kg, $/tonne[a,b]	
High Sulfur, _____J/kg, $/tonne[b]	
Other, e.g. Natural Gas (specify) _____J/kg, $/unit	
Nuclear Fuel Cycle	
Mining & Milling, $/kg U_3O_8[c]	
Conversion to UF_6, $/kg U	
Uranium Enrichment, $/SWU	
UO_2 Fabrication, $/kg HM[d]	
MOX Fabrication, $/kg HM[d]	
Spent-Fuel Transportation, $/kg HM	
Spent-Fuel Storage, $/kg HM-yr	
Reprocessing, $/kg HM[e]	
Waste Disposal, $/kg HM[f]	
Plutonium Transportation, $/g	
Plutonium Storage, $/g-yr	
Spent-Fuel Disposal, $/kg	
Losses in Conversion to UF_6, %	
Losses in Fabrication, %	
Losses in Chemical reprocessing, %	

(a) Low sulfur refers to coal that does not require sulfur-removal equipment to meet EPA standards.
(b) Contract price or estimated cost delivered to the plant. Provisions for escalation in contracts should be noted.
(c) Contract price or estimated cost for U_3O_8. Provisions for escalation in contracts should be noted.
(d) This cost should include shipping to reactor (HM stands for heavy metal in fuel, normally uranium plus plutonium).
(e) This cost should include the cost of waste solidification for disposal.
(f) This cost should include the cost of shipment to a Federal repository.

Table 9.2.3-6. Summary

Plant and Fuel-System Characteristics

Characteristic	Nuclear	Coal		Other, e.g., Gas
	(PWR/BWR)	High Sulfur	Low Sulfur	
Plant Thermal Power (MWt)	XXX	XXX	XXX	XXX
Generation - Gross (MWe)	XXX	XXX	XXX	XXX
Net (MWe)	XXX	XXX	XXX	XXX
No. of Generating Units	XXX	XXX	XXX	XXX
Heat-Rejection-Rate Total (J/h)	XXX	XXX	XXX	XXX
Heat Rejected in Cooling System (J/h)	XXX	XXX	XXX	XXX
Heat Rejected in Cooling System Blowdown (J/h)	XXX	XXX	XXX	XXX
Heat Rate (J/kWh)	XXX	XXX	XXX	XXX
Cooling-Water Req. (m^3/sec)	XXX	XXX	XXX	XXX
Cooling-System Type	XXX	XXX	XXX	XXX
FUEL SYSTEM				
Fuel Heating Value (J/kg)		XXX	XXX	XXX
Consumption (tonne or other units/yr)		XXX	XXX	XXX
Average Supply per Day		XXX	XXX	XXX
Sulfur Content of Solid Fuel		XXX	XXX	XXX
Ash Content of Solid Fuel		XXX	XXX	XXX
Location of Solid-Fuel Source		XXX	XXX	XXX
Ash Disposal (m^3/yr)		XXX	XXX	XXX
Sulfur-Removal System		XXX	XXX	XXX
Raw Materials (tonne/yr)		XXX	XXX	XXX
Waste Products (tonne/yr)		XXX	XXX	XXX
SO_x Emissions (tonne/yr)		XXX	XXX	XXX

Table 9.2.3-6. (contd)

Characteristic	Nuclear (PWR/BWR)	Coal		Other, e.g., Gas
		High Sulfur	Low Sulfur	
NO_x Emissions (tonne/yr)		XXX	XXX	XXX
Particulate Emissions (tonne/yr)		XXX	XXX	XXX
VOC Emissions (tonne/yr)				
CO_2 Emissions (tonne/yr)				
Nuclear-Fuel System				
U_3O_8 Consumption (tonne/yr)	XXX			
Specific Power MWt/MTHM	XXX			
Fuel load (kg U)	XXX			
New Fuel (trucks/yr)	XXX			
Spent Fuel (railcars/yr)	XXX			
High-Level Waste (m^3/yr)	XXX			
EQUILIBRIUM FUEL CYCLE				
Initial Enrichment (% U-235)	XXX			
Final Enrichment (% U-235)	XXX			
Burn up, Average (MWDT/kg U)	XXX			
Plutonium Production after Losses (g/kg U)	XXX			
TRANSMISSION SYSTEM				
New Corridors (km)	XXX	XXX	XXX	XXX
New Towers, Existing Corridors (km)	XXX	XXX	XXX	XXX
New Conductors, Existing Towers (km)	XXX	XXX	XXX	XXX

Table 9.2.3-7. Plant and Alternatives Capital-Investment Summary[a]

Date estimate made _____
Date cost escalated to _____

	Unit 1 ($)	Unit 2 ($)	Alternatives	Alternatives
DIRECT COST				
Land and Land Rights				
Physical Plant				
Structures and Site Facilities				
Reactor Plant Equipment				
Turbine Plant Equipment				
Electric Plant Equipment				
Misc. Plant Equipment				
Subtotal				
Spare Parts Allowance				
Contingency Allowance				
Subtotal				
INDIRECT COST				
Construction Facilities, Equipment, and Services				
Engineering and Const. Mgt. Services				
Other Costs				
Interest During Construction				
Subtotal				
Start of Const. Cost				
Escalation During Const. (__% yr.)				
Total Plant Capital Investment				
Cost, $ per kWe Net				
UNIT COST, MILL/kWh AT ___%, FIXED CHARGE RATE:				
50% Capacity Factor				
60% Capacity Factor				
70% Capacity Factor				

(a) Alternatives should include all generating and non-generating alternatives. For some alternatives such as conservation, different categories of "physical plant" may apply. Footnotes should describe assumptions, cost basis, references, unusual situation, etc.

Table 9.2.3-8. Summary of Nuclear-Fuel-Cycle Cost for A (PWR)

No Recycle					Recycle Pu & U				
Item	Escalation Rate %/yr[a]	19__-Cost[b] $/kgHM	19__-Cost[b] mill/kWh	Escalation to (19__) mill/kWh	30-yr Level Cost mill/kWh[c]	19__-Cost[b] $/kgHM	19__-Cost[b] mill/kWh	Escalation to (19__) mill/kWh	30-yr Level Cost mill/kWh[c]
U_3O_8 Cost as UF_6	XXX[d]	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Enrichment	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Fabrication	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
SPENT FUEL DISPOSAL:									
Storage, 5 yr/1 yr	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Shipping	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Disposal	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Reprocessing	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Waste Disposal	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Spent U-235 Credit	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Pu Credit	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Pu Storage, 1 yr	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Subtotal (constant $: show year $)	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

(a) Escalation rates that vary with time should be explained in footnotes.
(b) A burnup level of _____ MWD/MT was used to convert $/KgHM to mill/kWh.
(c) The discount factor used to obtain present value and levelized values should be indicated in a footnote.

Table 9.2.3-9. Fixed and Variable Portions of Operating and Maintenance Cost

Item	Nuclear			High SO_2 Coal			Low SO_2 Coal		
Capacity factor, %[a]	xx	xx	xx	xx	xx	xx	xx	xx	xx
O&M COST FOR INITIAL YEAR OF OPERATION									
Fixed, mill/kWh									
Variable, mill/kWh									
LEVELIZED COSTS[b]									
Fixed, mill/kWh									
Variable, mill/kWh									

(a) Capacity factors of 70, 60, and 50% are suggested.
(b) The O&M cost was escalated at _% per year and discounted at _% to obtain the present value. The present value was amortized over 30 years at _% to produce the levelized value.

Table 9.2.3-10. Carrying Charges for (BWR) Nuclear-Fuel Cycle

Charges	No Recycle			Recycle Pu & U		
Capacity Factor %[a]	xx	xx	xx	xx	xx	xx
CARRYING CHARGES FOR FUEL, (_%)						
(Yr) Dollars, $/kgHM						
Escalated to (year)						
30 years' Levelized Cost, $/kgHM[b]						
Levelized Unit Cost, mill/kWh[b]						

(a) Capacity factors of 70, 60, and 50% are suggested.
(b) The carrying charges were escalated at _% per year and discounted at ___% to obtain a present value. The present value was amortized over 30 years at __ % to produce the levelized value.

Table 9.2.3-11. Calculation of Levelized Costs of Coal

Costs	High Sulfur	Low Sulfur
(Year) Coal Cost, $/ton		
Escalated at %/yr to decision year ___, $/tonne		
1985 price escalated at ___% per yr, discounted at___% and amortized over 30 years, at ___%, $/ton		
Unit cost, mill/kWh		
(a) Using a net heat rate of _____ J/kWh and a coal heating value of _____ J/kg. (b) Using a net heat rate of _____ J/kWh and a coal heating value of _____ J/kg.		

Table 9.2.3-12. Cost and Carrying Charges for Coal Stockpile

Capacity Factor, %[a]	xx	xx	xx
COST OF 3 MONTHS STOCKPILE			
High-Sulfur Coal, 10^6			
Low-Sulfur Coal, 10^6			
UNIT COST OF CARRYING CHARGES[b]			
High-Sulfur Coal, Mill/kWh			
Low-Sulfur Coal, Mill/kWh			
(a) Capacity factors of 70, 60, and 50% are suggested. (b) Based on __% carrying charges.			

Table 9.2.3-13. Calculation of Cost of Decommissioning

Costs	Nuclear		Coal	Other
	Lowest Cost	Highest Cost		
Decommissioning Cost, 10^6 (a)				
Annual Sinking-Fund Payment, 10^6	--	--	--	
CAPACITY FACTOR, %				
Unit Cost, Mill/kWh	-- -- --	-- -- --	-- -- --	
(a) Cost estimates escalated at _% to 20__, the end of plant life.				

Table 9.2.3-14. Capital Cost and Unit Generation Cost Comparison for Nuclear and Coal-Fired Generation Station

Cost	Nuclear (U and Pu recycle)			Nuclear (No U or Pu recycle)			High-SO Coal			$_1$Low-SO_2Coal		
Capital Cost, $/kW, Net												
(Capacity Factor, %)[a]												
UNIT COST: MILL/kWh												
CAPITAL CHARGES EXCLUDING TAX												
Capital Charges for Tax (%)												
OPERATION & MAINTENANCE												
Fixed[b]												
Variable[b]												
Fuel Cost[b]												
Charges on Fuel Investment												
Decommissioning												
Total Mill/kWh												

(a) 30-yr levelized cost. Capacity factors of 50, 60, and 70% are suggested.
(b) The___ costs were escalated at _% per year and discounted at ___% per yr over a 30-yr lifetime to obtain present worth value. The present value was amortized at ___% over 30 yrs.

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9.3 ALTERNATIVE SITES

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and evaluation of alternatives to the applicant's proposed site for the construction and operation of a nuclear power plant. The scope of the review directed by this plan should include the analysis and evaluation of the region of interest, candidate sites and a reasonable number of proposed alternative sites identified by the applicant, and the methodology used by the applicant to identify these sites. The review should also include the staff's independent comparison of alternative sites with the applicant's preferred site to determine if there are any alternative sites that are environmentally preferable to the proposed site. When one or more environmentally preferable alternative sites are identified, the scope of this review should be extended, using benefit-cost techniques and other procedures to determine if any environmentally preferable site can be shown to be obviously superior to the applicant's proposed site.

"Region of interest" (ROI) is the geographic area considered in searching for candidate sites. "Candidate sites" are those sites (at least four) that are within the region of interest and that are considered in the comparative evaluation of sites to be among the best that can reasonably be found for the siting of a nuclear power plant. "Proposed site" is the candidate site submitted to the NRC by the applicant, or by a person requesting an early site review pursuant to Appendix A to 10 CFR 50, as the proposed location for a nuclear power plant. "Alternative sites" are those candidate sites that are specifically compared to the proposed site to determine if there is an obviously superior site. An "environmentally preferred" alternative site is a site for which the environmental impacts are sufficiently less than for the proposed site so that environmental preference for the alternative site can be established.

The basis for an ROI is the State in which the proposed site is located or the relevant service area for the proposed plant. The ROI must be more extensive if environmental diversity would be substantially improved or if candidate sites do not meet initial threshold criteria, and added geographic areas likely would not increase costs substantially. The region may be smaller if sufficient environmental diversity exists, threshold criteria are satisfied, and costs would be exorbitant for considering sites outside the State or relevant service area.

The review should be directed to identification of sites suitable for the size and type of nuclear power plant proposed by the applicant. Plant design modifications (e.g., cooling system design) may be considered on a site-specific basis.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 2.1. Obtain maps, photographs, and descriptions about the proposed site and surrounding area.
- ESRPs 2.2 through 2.8. Obtain input from the reviewers for information pertinent to a review of alternative power plant siting.
- ESRPs 4.4.1 through 4.4.3 and ESRPs 5.81 through 5.83. Obtain relevant socioeconomic impact estimates from the reviewers.
- ESRP 9.2.3. Provide information gathered on alternative sites.
- ESRP 10.4.3. Provide the results of the evaluation of these data for further analysis.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained.

(1) A description of the site-selection process, including

- objectives of the site-selection process (from the environmental report [ER])
- basic constraints and limitations (e.g., rules, regulations, and laws), giving the basis and rationale for their choice and applicability (from ER and consultations with relevant state public utility and power plant siting agencies)

- selection procedures for the region of interest, candidate areas, potential sites, candidate sites, and proposed site (from the ER)

- basis for establishing the geographical scope of the region of interest (from the ER)

- factors considered at each level of the selection process, parameters by which these factors were measured, and criteria used to define levels of quality (e.g., numerical limits or decision standards) (from the ER)[a]

- criteria used to screen potential sites (from the ER)

- methodologies used in the candidate site comparison process, including (when used) factors such as (1) importance factors, (2) preference functions, (3) utility functions, (4) weighing factors, (5) ranking scales, (6) scoring schemes, (7) rating systems, and (8) sensitivity analyses (from the ER).

(2) A description of the geographic area considered by the applicant, including (from the ER):

- major centers of population
- areas predicted to be deficient in power
- economic, demographic, and community characteristics (ESRPs 2.5.1 through 2.5.3)
- minority and low-income populations (ESRP 2.5.4)
- water bodies available for cooling
- railroads, highways, and waterways (existing and planned)
- topographic features
- major land-use classifications (e.g., residential, agricultural) and areas reserved for specific uses
- location and description of existing and planned primary electrical generating stations
- existing and planned transmission network
- transmission interconnections with other utilities
- natural and man-made features (e.g., zones of seismic activity, unusual geologic features, military installations) constituting potential hazards to construction or operation of a nuclear power plant.

These data should be supported by maps of adequate scale and detail.

(3) Descriptions of the following (from the ER):

- region of interest
- potential sites (including all sites within the ROI with an operating nuclear power plant or a construction permit for a nuclear power plant)

(a) See Appendix A to this ESRP for a checklist of selection process factors.

- candidate sites
- alternative sites.

(4) Descriptions of how the process described in Item 1 above was used to identify and select the items under (3) above (from the ER).

(5) Data sources used in the site-selection process, including results of site-specific field investigations (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of alternative sites are based on the relevant requirements of the following:

- 10 CFR 51.45 with respect to the contents of the ER and the need to discuss alternatives
- 10 CFR 51, Appendix A, with respect to alternatives including the proposed action
- 10 CFR 52.17 with respect to the evaluation of alternative sites in review of early site permits
- Coastal Zone Management Act of 1972 with respect to siting in coastal zones
- Endangered Species Act of 1973 with respect to critical habitats and species of concern
- Marine Protection, Research, and Sanctuaries Act of 1972 with respect to marine and other restricted habitats
- National Historic Preservation Act with respect to avoiding historic properties in site selection
- Executive Order 12898 with respect to location of minority and low-income populations.
- The Federal sources included in Table 4.1.1-1.

Regulatory positions and specific criteria necessary to meet the acceptance criteria include:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to alternative suitable plant sites
- Office of Nuclear Reactor Regulation (NRR), Office Letter No. 906, Revision 1, with respect to methods for including environmental justice in site selection. NRR Office Letter No. 906 is revised periodically. Obtain the latest revision for current guidance.

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998), with respect to evaluating site selection in terms of ecological systems, biota, and environmental justice

- Other Federal, State, regional, local, and Native American tribal acts, ordinances, requirements, and standards for land use, water use, water quality, and air quality

- State siting laws

- The Louisiana Energy Service Claiborne Enrichment Center decision.

Technical Rationale

The technical rationale for evaluating the applicant's alternative sites is discussed in the following paragraph:

> The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP section contributes to the consideration of alternatives by addressing alternative sites to determine if there is an obviously superior site in terms of environmental impacts and economic costs when compared to the proposed site.

III. REVIEW PROCEDURES

This review should accomplish the following objectives: (1) a brief description and evaluation of the applicant's process for evaluating alternative sites,[a] (2) presentation of the basis for the staff analysis, and (3) presentation of staff conclusions regarding alternatives to the proposed site. The fact that State authorities have approved the environmental acceptability of a site or a project after extensive and thorough environmentally sensitive hearings is properly entitled to "substantial weight" in this review.

The review involves a two-part sequential test for obvious superiority. The first stage of the test determines whether there are environmentally preferred sites among the candidate sites. The second stage of the test considers economics, technology, and institutional factors among the environmentally preferred sites to see if any is obviously superior. If there is no environmentally preferred or obviously superior site, the proposed site prevails; if an obviously superior site is found, the reviewer must identify this site and consult with the Environmental Project Manager (EPM).

The staff analysis of alternative sites is a critical element of the environmental review. However, a staff conclusion that an alternative site is obviously superior to the applicant's proposed site should normally lead to a recommendation that the application be denied.

(a) See Appendix B to this ESRP for a checklist of selection process factors.

Under the general guidance and direction of the EPM, the reviewer[a] should analyze the sites and procedures selected by the applicant. The objectives of this analysis procedure are to accomplish the following:

(1) Understand the applicant's site-selection methodology so that an eventual evaluation can be made of the reasonableness and capability of this process to identify candidate sites that are among the best that can reasonably be found.

(2) Analyze the reconnaissance-level information available on Geographical, Environmental, and Siting Information System (GEn&SIS) or from other sources used throughout the site-selection process so that an eventual evaluation of completeness and a staff determination can be made of whether the information is adequate for the level of screening for which it is used.

(3) Analyze the candidate-site evaluation procedure in the detail needed to be able to make an eventual evaluation that no site within the appropriate study area can be judged (by this or by any other acceptable and accurate procedure based on reconnaissance level data) to be obviously superior to the applicant's proposed site.

(4) Review and analyze the region of interest selected by the applicant so that an eventual evaluation of the appropriateness (e.g., in terms of geographical, demographic, legal, regulatory, and institutional restrictions) of the selected region can be made.

(5) Review and analyze the candidate areas selected by the applicant so that an eventual evaluation of the appropriateness (e.g., in terms of safety considerations, prohibited areas, geographic or engineering restrictions, and environmental restrictions) of the selected candidate areas can be made.

(6) Review the potential sites identified by the applicant so that an eventual evaluation can be made with respect to (a) adequacy of the site-identification process, and (b) consistency with the applicant's criteria for site selection.

(7) Analyze the candidate sites proposed by the applicant to the level needed to conclude that they are or are not potentially licensable sites and to identify the potential environmental impacts (adverse and beneficial) attributable to each site that would be used (a) by the applicant to select the proposed site, and (b) by the reviewer to determine the possible existence of an obviously superior site.

(8) Recognize that there will be special cases in which the proposed site was not selected on the basis of a systematic site-selection process. Examples include plants proposed to be constructed on the site

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(a) The environmental review of alternative sites should include all major aspects of environmental impacts of construction and operation, economic costs, and safety considerations. Accordingly, the activities and inputs of reviewers for all of the above technical disciplines should be required in the conduct of this review. "Reviewer," as used in this ESRP, refers to any discipline that may be affected.

of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a State government from a list of State-approved power-plant sites. For such cases, the reviewer should analyze the applicant's site-selection process only as it applies to candidate sites other than the proposed site, and the site-comparison process may be restricted to a site-by-site comparison of these candidates with the proposed site. As a corollary, all nuclear power plant sites within the identified region of interest having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant's proposed site.

(9) If it appears from the staff's review of the region that there may be an obviously superior site, the reviewer should alert the EPM to this finding.

The following analysis procedure should be used by the reviewer:

(1) Criteria should be developed for both construction and operational impacts, the criteria should consider both the site and vicinity and any needed transmission corridors. The reviewer should analyze the applicant's selection criteria from the viewpoint of their applicability to a wide variety of candidate sites, their value in permitting comparisons of potential impacts, and the practicality of obtaining the required data.

(2) In analyzing the site-selection process, the reviewer should consider how the impact data were obtained, how they were applied to each candidate site, and how the comparisons between sites were made. As a general rule, the EPM and specific reviewers for appropriate technical disciplines (e.g., land use, hydrology) should make an onsite inspection of each proposed alternative site. If necessary, this inspection may be extended to all alternative sites. The reviewer should determine the extent to which the following basic sources of impact information were used:

- review of the literature
- reports from Federal, State, regional, local, and affected Native American tribal agencies such as State geological agencies, EPA, U.S. Department of Agriculture, or county extension offices
- regional scientific, engineering, economic, and planning studies
- aerial photographs and topographic maps of candidate sites
- site-specific information from local citizens and from authorities associated with Federal, State, regional, local, and affected Native American tribal agencies, universities, and museums
- onsite inspections (if any) by technical specialists.

(3) The reviewer should consider the following topics addressed by the applicant in the ER:

- hydrology, water quality, and water availability
- aquatic biological resources, including endangered species
- terrestrial resources and land uses, including endangered species, and areas requiring special consideration
- transmission corridors
- socioeconomic factors, including aesthetics, archaeological and historic preservation, and environmental justice
- population distribution and density
- facility costs
- institutional constraints, as they affect site availability
- additional public concerns.

The reviewer should determine how this information was used to predict site-specific impacts, and how the impacts were assembled for a site-to-site comparison. The reviewer should analyze the cost data associated with site acquisition, environmental review, site preparation, and plant construction and should determine how these data were compared.

(4) The reviewer's evaluation of the individual elements of the applicant's site-selection process should include consideration of both the process (i.e., methodology) used by the applicant and the reasonableness of the product (e.g., potential sites) identified by that process. Evaluation procedures and criteria should include the following:

(a) Objectives and Procedures—The reviewer should ensure that the applicant's site-selection process was based on a documented procedure that includes as a minimum those elements described in the "Review Procedures" of this ESRP.

(b) Region of Interest—The reviewer should ensure that the selected region of interest has been adequately described and that its boundaries are consistent with those factors (e.g., deficient power areas) outlined in the "Review Procedures" of this ESRP. In making this determination, the reviewer should consider (1) how the applicant's ROI compares with the available geographical area, (2) the extent of and basis for restrictions to the ROI because of siting constraints, and (3) whether the ROI is consistent with the major load centers to be supplied by the proposed plant, and in particular, with those centers identified as being deficient in power. As a general rule, the plant should be located at a site in the area of the load center or centers that the plant is to serve over its lifetime. The reviewer should determine if the selected ROI will

permit such siting and must determine that potentially desirable candidate areas have not been excluded on the basis of an arbitrarily defined ROI.

(c) Candidate Sites—The reviewer should determine if the selection process used to identify candidate sites was adequate. Sites may be selected on the basis of a screening process to identify unacceptable areas (e.g., population density) or on the basis of positive attributes. A table similar to Table 9.3-1 may be used to document the process of candidate site selection and screening. The reviewer should ensure that factors identified below have been considered and whether the candidate areas identified by the applicant represent a reasonably complete list of such areas within the identified ROI.

To be a candidate site, the following minimum criteria must be met:

- Consumptive use of water should not cause significant adverse effects on other users.
- There should not be any further endangerment of Federal, State, regional, local, and affected Native American tribal listed threatened, endangered, or candidates species.
- There should not be any potential significant impacts to spawning grounds or nursery areas of populations of important aquatic species on Federal, State, regional, local, and affected Native American tribal lists.
- Discharges of effluents into waterways should be in accordance with Federal, State, regional, local, and affected Native American tribal regulations and would not adversely impact efforts to meet water-quality objectives.
- There would be no preemption of or adverse impacts on land specially designated for environmental, recreational, or other special purposes.
- There would not be any potential significant impact on terrestrial and aquatic ecosystems, including wetlands, which are unique to the resource area.
- Population density and numbers conform to 10 CFR 100.
- There are no other significant issues that affect costs by more than 5% or that preclude the use of the site.

(d) Screening Process—The reviewer should determine if an adequate, well documented process for screening candidate sites was employed, and that all potential sites were screened in a consistent manner. The reviewer should consider all screening criteria employed by the applicant in light of the objective of this process (i.e., to identify potentially licensable sites). The reviewer should compare the applicant's procedures with the recommendations of Regulatory Guide 4.7 and, when inconsistent, should coordinate with the EPM to determine the reasons for the variances.

Based on reconnaissance level information, the reviewer should determine if the candidate sites identified by the screening process may be considered as potentially licensable and should also determine that there is reasonable assurance that no potential alternative sites in this category have been omitted. Although there can be no specific criteria for determining that an adequate number of candidate sites have been identified, the reviewer should make such a determination, based on the ROI, the number of candidate areas, and the number and type of alternative sites evaluated by the applicant. In general, however, the identification of two or more different areas and three to five alternative sites in addition to the proposed site could be viewed as adequate.

(e) Alternative-Site Evaluation—The objective of this phase of the evaluation procedure is (1) to determine if the applicant has reasonably identified alternative sites, predicted the environmental impacts of construction and operation at these sites, and developed and used a logical, reproducible means of comparing sites that has led to the applicant's selection of the proposed site, to determine if it is environmentally preferable, and (2) to determine if any alternative site can be shown to be obviously superior to the applicant's proposed site. This analysis may be documented in a table such as Table 9.3.2, which records summary environmental information on each alternative site; the conclusion of environmental preferability for any sites; consideration of cost, institutional, and other factors; and any identification of an obviously superior site. Many of the following evaluation steps must be based on the reviewer's judgment. For these evaluations, the principal criterion will be that of reasonableness of the applicant's data and procedures. The reviewer should make the following determinations:

- Site Identification—The reviewer should determine that the alternative sites have been identified with sufficient precision to permit field inspections to determine specific environmental parameters. If the applicant is unable to provide precise candidate site boundaries, and if the reviewer determines that the reasons for this are valid, the reviewer should evaluate the general site area instead.

- Environmental Descriptions—The reviewer should determine that environmental descriptions for the alternative sites are adequate to assess environmental impacts of plant construction and operation, and that the basic sources of information described in Section III of this plan have been used to provide these data. The reviewer should determine if all sources of information reasonably available to the reviewer and providing useful environmental description data were used.

- Site Comparison—The reviewer should determine that the applicant's final site-selection process is reasonable, makes full use of the candidate site data available, and presents the data in a manner that permits valid comparisons between sites. The objective of this evaluation of the applicant's process is not to determine that the applicant has selected the best site (since on the basis of previous evaluations, the reviewer has determined those candidate sites that can reasonably be expected to be licensable), but is to determine if any candidate site can be judged as obviously superior to the applicant's proposed site. The criterion for making this determination is that one or more important aspects, either singly or

in combination, of a reasonably available alternative site are obviously superior to the corresponding aspects of the applicant's proposed site, and the alternative site does not have offsetting deficiencies.

Because reviewer judgment is required for the decision that a site attribute is obviously superior, any such conclusion must be supported by the corresponding ESRP Chapters 2.0, 4.0, and 5.0 reviewers. The reviewer need not establish or confirm a relative ranking of candidate sites, but must determine by means of one-by-one comparisons that no alternative site is obviously superior to the proposed site.

When the reviewer determines that an obviously superior site can be identified, the reviewer should consult with the applicant to determine the applicant's reasons (if not already known) for not selecting the obviously superior site. In addition, the reviewer should document the conclusion that an alternative site is obviously superior to the proposed site.

- Impact Predictions—The reviewer should determine that basic impact criteria (e.g., land use, water use) have been developed for each alternative site, using the environmental descriptions established by the applicant and considering the basic construction and operational parameters of the proposed plant.

- Cost Data—The reviewer should determine that economic-cost data associated with each alternative site have been presented, are reasonable, and permit comparison between the candidate sites.

The following general guidance is provided for the reviewer in arriving at conclusions:

- The reviewer should determine if the applicant has employed a practicable site-selection process with the principal objective of identifying candidate sites that would be among the best that could reasonably be found for the proposed plant. This standard implies that all such candidate sites should be licensable. The reviewer should determine if the applicant's proposed site was selected from this list of candidate sites. The reviewer should determine whether the reconnaissance-level information used throughout the site-selection process was complete enough and of sufficient depth commensurate with the level of screening to support the decisions that were made.

- The reviewer should determine if the applicant's candidate sites represent the best that could reasonably have been found within the ROI, and if they do not, should request further information from the applicant. If the sites are the best that could be found, the reviewer should determine if any such site is environmentally preferable to the applicant's proposed site. When such a determination is made, the reviewer should conduct a benefit-cost balance and comparison of the estimated costs (environmental, economic, and time) of completing construction of the proposed plant at the proposed site and at the environmentally preferable site or sites. The reviewer should use the results of this benefit-cost balance to determine if any environmentally preferable site can be shown to be obviously superior to the applicant's proposed site.

IV. EVALUATION FINDINGS

The following information should be provided for the EIS in a summary format:

(1) Applicant's Site-Selection Process

- a description of the applicant's documented site-selection process methodology, including a summary of the process objectives
- a description of the selected region of interest
- a list and general description of the candidate sites
- a description of the alternative sites.

(2) Staff Analysis

- a description of the process used by the staff to review the applicant's methodology
- the selected ROI
- candidate sites and alternative sites
- the selection criteria used by the applicant.

(3) Staff Conclusions

- conclusions with respect to the applicant's methodology
- conclusions with respect to the reconnaissance level information
- conclusions with respect to the applicant's selection criteria
- conclusions with respect to the applicant's selection process on
  - region of interest
  - candidate sites
  - alternative sites.
- conclusions with respect to the applicant's objective to identify candidate sites that are among the best that could reasonably have been found
- conclusions with respect to the identification of an obviously superior site.

For reviews related to CP, COL, and early site permit applications, the reviewer verifies that sufficient information has been provided and that the NRC staff evaluation supports concluding statements of the following type to be included in the EIS:

> The staff reviewed the available information on the preferred and alternative sites. Based on this review, the staff concludes that the alternative sites are not obviously superior to the site under consideration.

If after the evaluation, the conclusion is reached that one of the alternative sites under consideration should be the preferred site, a statement similar to the following should be included, followed by a list of the areas in which the alternative site is a better choice:

The staff reviewed the information submitted by the applicant. Based on this review, the staff concludes that the analysis does not adequately support the preferred alternative site in that an obviously superior site has been identified. The staff finds the site deficient in the following areas... when compared to the alternative site.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants."

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 52.17, "Contents of application."

10 CFR 100, "Reactor Site Criteria."

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." 59 *Federal Register* (32): 7629-7633.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

National Historic Preservation Act, as amended, 16 USC 470 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1998a. *General Site Suitability for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1998b. In the Matter of Louisiana Energy Service Claiborne Enrichment Center. Docket 70-3070-ML. CLI-98-3. Washington, D.C. April 3, 1998.

U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Reactor Regulation (NRC/NRR). 1996. "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues." NRR Office Letter No. 906, Revision 1, Washington, D.C.

Table 9.3-1. Selection of Candidate/Alternative Sites

Subject Areas for Candidate Site Selection and Screening	Site 1	Site 2	Site 3
Land use, including availability, and areas requiring special consideration			
Hydrology, water quality, and water availability			
Terrestrial resources (including endangered species)			
Aquatic biological resources, including endangered species			
Socioeconomics (including aesthetics, archeological and historic preservation, and environmental justice)			
Transmission corridors (approximate length and general location, feasibility, and resources affected)			
Population distribution and density			
Facility costs			
Institutional constraints, as they affect site availability			
Additional public concerns			
(For candidate site selection) Is this site a candidate site? (Yes/No)			
(For candidate site screening) Is this candidate site a good alternative site to the proposed site? (Yes/No)			

Table 9.3-2. Evaluation of Alternative Sites

Topic Areas for Evaluation of Alternative Sites	Alternative Site 1	Alternative Site 2	Alternative Site 3
Land use, including transmission corridors and impacts on areas requiring special consideration			
Hydrology, water quality, and water availability			
Terrestrial resources (including endangered species)			
Aquatic biological resources, including endangered species			
Socioeconomics (including aesthetics, archeological and historic preservation, and environmental justice)			
Is site environmentally preferable to proposed site? (Yes/No)			
Facility costs			
Institutional constraints, as they affect site availability			
Additional public concerns			
Is site obviously superior to the proposed site? (Yes/No)			

APPENDIX A

EVALUATION FACTORS

Engineering and Environmental

Aesthetics
Commitment of resources
Demography
Ecological sensitivity
Geology
Hydrology
Meteorology
Seismicity
Socioeconomics
Transportation access

Land Use

Agriculture
Dedicated areas
Industry
Land availability
Land-use planning
Recreational usage

Water Use

Water accessibility
Water availability
Water quality

Institutional

Federal restrictions
Local/regional/Tribal restrictions
State restrictions

Construction

Equipment and materials handling
Work-force availability and accessibility
Work-force housing

Cost

Access roads and railways
Construction costs
Cooling system
Fuel costs
Intakes and discharges
Land and water
Operating and maintenance costs
Site preparation
Station facilities
Transmission and substations

Transmission

Access to existing network
New corridors
Reliability
Transmission losses

APPENDIX B

CRITERIA FOR IDENTIFYING OBVIOUSLY SUPERIOR SITES

Demography

In terms of a review of demographic aspects of the site-selection process, the population density guidelines of Regulatory Guide 4.7 have been interpreted by the staff in the following manner:

- If, on balance, there are alternative sites of approximately equal merit regarding issues other than population density,
- If the proposed site has a population density substantially greater than one of the alternative sites, and
- If that density is in excess of the stated Regulatory Guide 4.7 values, there does exist a site obviously superior to the proposed site.

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9.4 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the evaluation of alternative plant and transmission systems. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 9.4.1 through 9.4.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulation identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluation of the applicant's alternative plant and transmission systems is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of material to overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 9.4.1 through 9.4.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

9.4.1 HEAT DISSIPATION SYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis of alternatives to the applicant's proposed heat dissipation system. This includes evaluating 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 should be compared with the proposed system on a benefit-cost basis to determine if any such system should be considered as a preferred alternative to the proposed system.[a]

The scope of the review directed by this plan should 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 Federal, State, regional, or local regulations, or Native American tribal agreements, (2) are consistent with any findings of the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act (CWA), and (3) can be judged as practical from a technical standpoint with respect to the proposed dates of plant construction and operation. This review should also include the investigation of alternatives proposed by other reviewers to mitigate impacts associated with construction and operation of the proposed heat dissipation system.

(a) The review of environmentally preferable heat dissipation systems should include both environmental and economic considerations. The activities of and information from two or more reviewers may be needed in conducting this portion of the review.

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 and conclusions regarding any such systems having an equivalent or better benefit-cost balance than the proposed system.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 2.2.1, 2.3.1, 4.1.1, 4.3.1, 5.1.1, and 5.3.3.2. Obtain input from the reviewers for these ESRPs to develop the comparative land-use and ecological impact data with regard to heat dissipation systems.

- ESRPs 2.3, 4.2.2, 4.3.2, and 5.2.2. Obtain input from reviewers to develop the comparative water-quality and water-use data.

- ESRPs 2.7 and 5.3.3.1. Obtain input from the reviewers to develop comparisons, which may be based on verified applicant supplied data or on independent staff estimations of atmospheric effects.

- ESRPs 2.3.1, 4.2.1, and 5.2.1. Obtain input from the reviewers for assistance in comparing each alternative heat dissipation system with the effects of the proposed system.

- ESRPs 2.5, 3.1, 5.8.1, and 5.8.2. Obtain input from the reviewers when comparing the aesthetic impacts and potential recreational benefits of each alternative system with those of the proposed system.

- ESRP 3.3.1. Obtain plant water consumption data to be used in the evaluation of impacts using component alternatives.

- ESRPs 4.1.3 and 5.1.3. If proposed construction or operation of the heat dissipation system may result in adverse impacts to historic properties, obtain information regarding alternative systems or locations that may be taken into consideration as a means to avoid the impacts.

- ESRPs 4.4.1 through 4.4.3. If socioeconomic impacts from construction of the heat dissipation system appear to be adverse, consider alternative systems or locations to avoid the impacts.

- ESRPs 4.6 and 5.10. Provide a list of those measures and controls to limit adverse heat dissipation system impacts that were developed as a result of this environmental review.

- ESRP 9.4.2. Obtain input from the reviewers when an alternative heat dissipation system would involve the use of intake or discharge systems that would be substantially different from the proposed system.

- ESRPs 10.1 through 10.4.3. Provide data and information to the appropriate reviewers to permit the inclusion of any such alternatives in the final evaluation of the proposed action when suggested consideration of an alternative heat dissipation system is determined to be environmentally preferable.

- Interface with the Environmental Project Manager (EPM). Obtain input from the EPM when an alternative heat dissipation system appears to be environmentally preferable and meets regulatory requirements.

Data and Information Needs

The kinds of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the practicality of adapting the potential alternative to the proposed site. The following data or information should be obtained:

(1) proposed heat dissipation system and for each potential alternative as follows:

- land-use requirements (from ESRP 3.1 and the environmental report [ER])
- water-use requirements (from ESRP 3.3.1 and the ER)
- operating and maintenance experience for similar units (from the ER and the general literature)
- capital, maintenance, and operating costs (from the ER and the general literature)
- effect on generating efficiency (from the ER and the general literature)
- predicted thermal and physical effects, e.g., thermal plume, scouring (from ESRPs 5.3.1.1 and 5.3.2.1 and the ER)
- predicted atmospheric effects, e.g., fogging, icing, drift (from ESRP 5.3.3.1 and the ER)
- predicted operating noise levels (from ESRP 5.8.1 and the general literature)
- predicted aesthetic effect, e.g., visual plumes (from the ER)
- predicted recreational benefits (from the ER)

(2) site and vicinity land use, current and projected (from ESRP 2.2.1)
(3) site and vicinity hydrological data (from ESRP 2.3.1)
(4) site and vicinity water use, current and projected (from ESRP 2.3.2)
(5) site and vicinity water-quality criteria (from ESRP 2.3.3)
(6) site and vicinity ecological data (from ESRP 2.4)
(7) site and vicinity meteorological characteristics (from ESRP 2.7).

II. ACCEPTANCE CRITERIA

The analysis of alternative plant heat dissipation systems is a necessary step in the environmental impact statement (EIS) process. The acceptance criteria for this analysis are based on the relevant requirements of the following:

- 10 CFR 51.71(a) referring to 10 CFR 51.45(a)(3) with respect to the need to discuss alternatives in the environmental analysis
- 10 CFR 51, Appendix A, discussing alternatives to the proposed action
- Fish and Wildlife Coordination Act of 1958
- Marine Sanctuaries Act of 1972 (amended 1995)
- Marine Mammal Protection Act (amended 1994)
- Coastal Wetlands, Planning Protection and Restoration of 1990
- Coastal Zone Management Act of 1972 (amended 1992)
- CWA of 1987
- 40 CFR 122 with respect to NPDES permit conditions specified in the CWA
- Endangered Species Act of 1973 (amended 1988).

Regulatory positions and specific criteria necessary to meet the regulations as identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to alternative systems designs.

- Memorandum of Understanding Between NRC and the Army Corps of Engineers for the Regulation of Nuclear Power Plants (40 FR 37110, August 25, 1975) with respect to locating structures affecting navigable waters.

- Federal, State, regional, local, and affected Native American tribal agencies, on water use, air and water quality, effluent discharge, and land use.

Technical Rationale

The technical rationale for evaluating alternatives to the applicant's heat dissipation systems is discussed in the following paragraph:

> The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP section contributes to the consideration of alternatives by addressing alternative means of heat dissipation to determine if there is an obviously superior method in terms of environmental impacts and economic costs when compared to the proposed system.

III. REVIEW PROCEDURES

The principal objectives of this analysis are (1) to provide assistance to the reviewers for ESRP Chapters 4.0 and 5.0 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 should be governed by the nature and magnitude of proposed heat dissipation system impacts predicted by the reviews of ESRP Chapters 4.0 and 5.0. If adverse impacts are predicted, the reviewers should coordinate 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) should be the baseline system against which alternative heat dissipation systems are compared. The nature and adversity of the remaining unmitigated impacts for this baseline system should establish the level of analysis required in the review of alternative systems. This should 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 should 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, the review should be expanded to consider the economic costs of any such alternative. This analysis should be done in consultation with appropriate ESRP 10.4 reviewers. Assistance from these reviewers should be requested to establish the economic-cost data to be used to develop a benefit-cost comparison with the baseline (proposed) heat dissipation system.

The reviewer should 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):

- once through systems
- closed cycle systems:
  - mechanical draft wet cooling towers (including circular towers)
  - natural draft cooling towers (including fan assisted towers)
  - wet dry cooling towers
  - dry cooling towers
  - cooling ponds
  - spray ponds.

The reviewer should consider these alternatives for construction and operation at the applicant's proposed site. The analysis should 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 should 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 should not be considered in this initial screening. Working through the EPM, the reviewer may consult with appropriate Federal and State agencies when needed to conduct this screening. The reviewer should also consult (through the EPM)

with the appropriate National Pollutant Discharge Elimination System (NPDES) administrative agencies to screen those alternatives that will not meet CWA requirements. 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 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 should initially consider only the environmental factors and should 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 should be based on the environmental and economic factors shown in Table 9.4.1-1. The reviewer should 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 presented 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 should involve the following:

(1) Land Use—Determine (1) the onsite land-use requirements of each system, (2) 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, (3) the extent to which any system is sited on or results in modifications to the floodplain,[a] and (4) the impacts to terrestrial biota associated with system construction and operation. The reviewer should consult with the reviewers for ESRPs 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.

Table 9.4.1-1. Screening of Alternative Heat Dissipation Systems

Factors Affecting System Selection	Alternative 1	Alternative 2	Alternative 3
Land-use Onsite land requirements Terrain considerations			
Water use			
Legislative restrictions			
Is this a suitable alternative heat dissipation system? (Yes/No)			

(a) See ESRP 2.3.1 for a definition of the floodplain.

(2) Water Use—Determine (1) the water-use requirements of each system, including intake requirements, water consumption, and intake/discharge water quality and quantity, (2) the practicality of this water use within the specifics of water availability and the impacts of present and known future water uses, and (3) the impacts of aquatic biota associated with system construction and operation. The reviewer should compare these data with characteristics of the proposed heat dissipation system. The economic cost of water consumed should be considered when these data are available. The reviewer should consult with the reviewers for ESRPs 2.3, 4.2.2, 4.3.2, 5.2.2, and 5.3 to develop the comparative water quality, water use, and ecological impact data.

(3) Atmospheric Effects—Determine the predicted atmospheric effects of each alternative heat dissipation system (e.g., the extent and magnitude of cooling tower drift) and compare these effects with those of the proposed system. The reviewer should consult with the reviewers for ESRPs 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—Estimate the predicted thermal and physical effects (e.g., thermal plumes, erosion, scouring) of each alternative heat dissipation system, and compare these effects with those of the proposed system. The reviewer should consult with the reviewers for ESRPs 2.3.1, 4.2.1, and 5.2.1 for assistance in making this comparison.

(5) Noise Levels—Estimate operational noise levels for each of the alternatives and compare them with the predicted operating noise levels of the proposed system and with any Federal, State, regional, local, or affected Native American tribal restrictions. The reviewer should consider construction noise levels when these could be significant.

(6) Aesthetics and Recreational Benefits—Compare the aesthetic impacts and potential recreational benefits of each alternative system with those of the proposed system. The reviewer should consult with the reviewers for ESRPs 2.5, 3.1, and 5.8 for assistance in making this comparison.

(7) Operating and Maintenance Experience—Compare operating and maintenance experience of each alternative with the proposed system to develop a projected reliability factor for each system.

(8) Generating Efficiency—Estimate the plant electrical generation efficiency for each alternative heat dissipation system and compare it with the generating efficiency using the proposed system.

(9) Costs—Estimate the capital, operating, and maintenance costs for the proposed system and for each alternative considered. The reviewer should use these figures for economic-cost comparisons. The reviewer should determine if there are any site-specific factors that might affect the costs of any alternative and 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, repeat these

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. The reviewer should consult with the reviewer for ESRP 9.4.2.

The reviewer should ensure that each heat dissipation system alternative has been described in sufficient detail to enable 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 should ensure that economic-cost data are available in sufficient detail to enable the reviewer to conduct benefit-cost balance and comparisons with the proposed system leading to a final staff conclusion for heat dissipation-system consideration. The reviewer should also ensure that all comparisons are made on the basis of the proposed system as supplemented with those measures and controls to limit adverse impacts proposed by the applicant and concurred with by the staff. For those alternatives eliminated from consideration on the basis of land-use, water-use, or legislative restrictions, the reviewer should ensure that adequate documented justification for this action has been prepared.

(1) General Considerations—If a mitigation measure or alternative heat dissipation system is to be considered, 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 could result in an equivalent or improved project benefit-cost balance. When these criteria are met, the reviewer should verify those mitigation measures proposed by the reviewers for ESRP Chapters 4.0 and 5.0 or should consider an alternative heat dissipation system. The reviewer should be guided by the following general considerations:

- 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 should allow for this when evaluating the comparative environmental impacts of each proposed alternative with those of the proposed system.

- 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.

- Adjust the economic costs of each alternative system on the basis of equivalent generating capacity.

- The evaluation of alternative heat dissipation systems should include consultation and coordination with those agencies responsible for NPDES administration. The reviewer should coordinate the evaluation of measures and controls to limit adverse impacts, or of alternatives to avoid adverse impacts (with the EPM as liaison), with NPDES administrators. When consulting with the EPA or with agencies of States having memoranda of understanding with NRC, the reviewer should ensure that the staff analyses and evaluations (1) are consistent with the details of these memoranda and (2) will serve the needs of these agencies.

(2) Measures and Controls to Limit Adverse Impacts—When considering measures provided by the reviewers for ESRP Chapters 4.0 and 5.0 to mitigate adverse environmental impacts predicted for the proposed heat dissipation system, the reviewer's verification of the desirability of the measure should lead to the following conclusions:

- 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, regional, local, and affected Native American tribal regulations or ordinances.
- The measure is consistent with NPDES restrictions.

(3) Alternative Heat dissipation Systems—The initial step in the evaluation of those alternative heat dissipation systems identified by the analysis procedure of this ESRP should 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 should be applied to this evaluation:

- 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 CWA, the reviewer should conclude that there are no environmentally preferable heat dissipation-system alternatives. When this conclusion is reached, the reviewer should evaluate the alternatives to identify those that may be considered environmentally equivalent. For this condition, environmental "equivalence" means that an alternative has no unavoidable adverse impacts and meets CWA requirements. The reviewer should not indicate a preference between environmentally equivalent alternatives nor should benefit-cost balancing be made when this condition prevails. Alternatives having unavoidable adverse environmental impacts or that do not meet CWA requirements should be judged environmentally inferior to proposed heat dissipation systems meeting these conditions.

- When the reviewer determines that the proposed heat dissipation system will meet CWA requirements, but is predicted to have unavoidable adverse environmental impacts, the reviewer should evaluate the identified alternative systems for potential environmental preference to the proposed system. The scope and extent of this evaluation should depend on the nature and magnitude of the proposed system's environmental impacts. An environmental review for the alternatives may be needed following the analysis and evaluation procedures of the appropriate ESRP Chapters 4.0 and 5.0. The following criteria apply to this evaluation:

- *Environmental preference will be established* when an alternative can be shown to have no unavoidable adverse impacts and will meet CWA requirements.

- *Environmental preference may be established* when an alternative that meets CWA 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 should involve consultation with the EPM and the appropriate ESRP Chapter 4.0 and 5.0 reviewers. This consultation should result in a joint determination of the status of any such alternative.

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

- *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 CWA requirements.

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

- When environmentally preferable alternative heat dissipation systems have been identified, the reviewer should ensure that economic cost data have been developed for the alternatives and that these data are adequate for a benefit-cost balancing and comparison with the proposed system. This portion of the evaluation procedure should be conducted with the assistance of appropriate ESRP 10.4 reviewers. The reviewer should complete the economic and reliability portions of Table 9.4.1-1. On the basis of the completed table, the reviewer should 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 considered an alternative to the proposed system. For those cases in which the benefits of the alternative are less than those of the proposed system (e.g., lower electrical output or decreased reliability) or if economic costs are greater than those of the proposed system, a conclusion that the alternative should receive additional consideration should involve consultation with the EPM and with the appropriate ESRP Chapter 4.0 and 5.0 reviewers. If this consultation establishes that the benefit-cost balances of such alternatives are no more than equivalent to the proposed system, the alternatives should not receive further consideration. When alternatives have significantly decreased benefits or increased economic costs, they should be rejected for any further consideration as alternatives to the proposed systems.

IV. EVALUATION FINDINGS

This review should 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 relative to alternative heat dissipation systems.

The input to the EIS should 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 seeking environmentally preferable alternatives to the proposed heat dissipation system, and (4) the staff's conclusions related to consideration of alternative heat dissipation systems. Staff contacts with the EPA or with agencies responsible for NPDES determinations should be referenced.

The reviewer should discuss briefly those alternatives rejected because of specific deficiencies and state why each alternative was rejected. The reviewer should also identify those alternatives judged environmentally equivalent or inferior to the proposed system. The use of a table similar to Table 9.4.1-1 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.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination System."

Coastal Wetlands, Planning Protection and Restoration Act of 1990.

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Marine Mammal Protection Act, as amended, 16 USC 1361 et seq.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

Memorandum of Understanding for the Regulation of Nuclear Power Plants. 40 *Federal Register* 37110 (August 25, 1975).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

9.4.2 CIRCULATING WATER SYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis of alternatives to the applicant's proposed circulating water systems. This includes evaluation of 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 should be compared with the proposed system on a benefit-cost basis to determine if any such system should be considered as a preferred alternative to the proposed system.[a]

The scope of the review directed by this plan should 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 Federal, State, regional, local, and affected Native American tribal agreements, (2) are consistent with any of the National Pollutant Discharge Elimination System (NPDES) or the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act (CWA) findings, and (3) can be judged as practical from a technical standpoint with respect to the proposed dates of plant construction and operation. This review should 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 should include (1) alternative intake designs and locations,

(a) The review of environmentally preferable circulating water systems should consider both the environmental and economics; two or more reviewers may be needed to conduct this portion of the review.

(2) alternative discharge designs and locations, (3) alternative water supplies, and (4) alternative water treatment. The reviewer should 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 regarding any such systems having an equivalent or better benefit-cost balance than the proposed system.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 2.3.2, 4.1.1, 4.3.1, 5.1.1, 5.3, and 5.3.3.2. Obtain input from these reviewers to develop the comparative land-use and ecological impact data.

- ESRPs 2.3, 4.2.2, 4.3.2, and 5.2.2. Obtain input from these reviewers to develop the comparative water-quality, water-use, and aquatic ecological impact data.

- ESRP 3.3.2. Obtain descriptions of water treatment systems that may be used in comparisons or evaluation of alternative water-treatment systems.

- ESRPs 4.1.3 and 5.1.3. If proposed construction or operations of the circulating water system results in adverse impacts to historic properties, obtain information regarding alternative systems or locations that may be taken into consideration as a means to avoid the impacts.

- ESRPs 4.4.1 through 4.4.3. If socioeconomic impacts from proposed construction of the circulating water system appear to be adverse, obtain information regarding alternative systems or locations that may be taken into consideration as a means to avoid the impacts.

- ESRPs 5.3.1.2, 5.3.3.1, 5.3.3.2, and 5.8.2. Obtain input from these reviewers to develop comparisons of intake and discharge effects.

- ESRPs 4.6 and 5.10. Provide these reviewers, 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.

- ESRPs 10.4.1 and 10.4.2. Provide relevant data and information to the appropriate ESRP Chapter 10.0 reviewers to permit the inclusion of any such alternatives in the final evaluation of the proposed action if an obviously superior alternative circulating water system or system component is identified.

- Interface with Environmental Project Manager (EPM). Obtain input from the EPM when an alternative circulating water system appears to be environmentally preferable and meets regulatory requirements.

Data and Information Needs

The degree of detail should 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. Data or information should be obtained for the following systems:

(1) Intake Systems

- 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 environmental report [ER])
- alternative pumping facilities, if proposed (from the ER)
- alternative locations of the proposed intake system and pumping facility on the same waterbody (from the ER)
- alternative procedures and schedules for intake defouling, including any use of defouling chemicals (from the ER)
- descriptions and operational characteristics of any alternative trash racks, traveling screens, trash baskets, or fish return systems (from the ER)
- predicted physical impacts from hydrologic alternatives and impacts to aquatic ecosystems, including entrapment, impingement, and entrainment, for each alternative intake system (from the ER)
- capital, maintenance, and operating costs for each alternative intake system and costs associated with system adaptation to the proposed site (from the ER).

(2) Discharge Systems

- 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)
- description of alternative discharge lines (or canals) from the heat dissipation system to the receiving water body (from the ER)

- description of alternative locations of the proposed discharge system on the same water body (from the ER)

- estimated physical impacts from hydrologic alterations and impacts to aquatic biota for each alternative discharge system (from the ER)

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

(3) Water Supply

- 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 Federal, State, regional, local, and affected Native American tribal agencies)

- water availability data, including groundwater 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)

- present and known future restrictions on use of water from alternative water sources (from the ESRPs 2.3.1 and 2.3.2)

- economic and environmental cost data for water delivered from each alternative source (from the ER).

(4) Water Treatment

- description and purpose of alternative water treatment systems for

  - circulating water system (from the ER)
  - plant (service) water system (from the ER)

- chemicals and additives (or mechanical treatment) to be used in each alternative water treatment system (from the ER)

- operating cycles for each alternative water treatment system (from the ER)

- capital, maintenance, and operating costs for each alternative water treatment system (from the ER and the general literature).

(5) Other Data

- site and vicinity hydrological data (from ESRP 2.3.1)

- site and vicinity water use, current and projected (from ESRP 2.3.2)
- site and vicinity water-quality criteria (from ESRP 2.3.3)
- site and vicinity ecological data (from ESRP 2.4)
- proposed circulating water system design and operation (from ESRPs 3.3.2 and 3.4)
- plant water use (from ESRP 3.3.1)
- 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)
- 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).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of alternatives to the proposed circulating water system are based on the relevant requirements of the following:

- 10 CFR 51.71(a) referring to 10 CFR 51.45(a)(3) with respect to the need to discuss alternatives in the environmental analysis
- 10 CFR 51, Appendix A, with respect to discussing alternatives to the proposed action
- 40 CFR 122 with respect to NPDES permit conditions specified in the CWA
- CWA of 1987
- Coastal Wetlands Planning, Protection, and Restoration Act of 1990
- Coastal Zone Management Act of 1972 (amended 1992)
- Endangered Species Act of 1973 (amended 1988)
- Fish and Wildlife Coordination Act of 1958
- Marine Mammal Protection Act (amended 1994)
- Marine Sanctuaries Act of 1972 (amended 1995)

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to alternative systems designs

- Memorandum of Understanding for the Regulation of Nuclear Power Plants (40 FR 37110) with respect to the NRC exercising primary responsibility for the conduct of EISs for nuclear power plants

- Federal, State, regional, local, and affected Native American tribal regulations on water use, air and water quality, effluent discharge, and land use.

Technical Rationale

The technical rationale for evaluating alternatives to the applicant's proposed circulating water systems is discussed in the following paragraph:

> The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP section contributes to the consideration of alternatives by addressing alternative means of cooling water circulation to determine whether there is an obviously superior method in terms of environmental impacts and economic costs when compared to the proposed system.

III. REVIEW PROCEDURES

The principal objectives of this analysis procedure are (1) to provide assistance to those ESRP Chapter 4.0 and 5.0 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 should be governed by the nature and magnitude of proposed circulating water system impacts predicted by the ESRP Chapter 4.0 and 5.0 reviewers. When adverse impacts are predicted, the reviewer should coordinate 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) should 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 should 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. If no adverse impacts have been predicted for the proposed system, the review should be limited to an analysis of 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, the review should be expanded to consider the economic costs of any such alternative. The reviewer should estimate the capital, operating, and maintenance costs for each circulating water system component considered and for each component of the proposed system. The reviewer should use these data to estimate total annual costs for each system and should use these annual costs for economic-cost comparisons. The reviewer should determine if there are any site-specific factors that might affect the costs of any alternative and should factor these increased or reduced costs into the comparison. As necessary, these cost estimates should 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 should be done in consultation with appropriate reviewers for ESRPs 10.4.1 through 10.4.3. Assistance from these reviewers should be requested to establish the economic-cost data used to develop a benefit-cost comparison with the baseline (proposed) circulating water system.

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

(1) intake systems
(2) discharge systems
(3) water supply
(4) water treatment.

The analysis should consider only those alternatives that are applicable at the proposed site and compatible with the proposed heat dissipation system.[a]

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 should initially consider only the environmental factors and should repeat the procedure for economic factors only for those alternatives shown to be environmentally preferable by the evaluation procedures of this ESRP.

Initial Environmental Screening

The reviewer should consider the following factors in the 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. Economic factors should not be considered in this initial screening.

- plant water requirements
- site terrain and relationship to water bodies

(a) Alternative heat dissipation systems are the subject of ESRP 9.4.1. 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 should provide assistance in determining appropriate circulating water system components for such heat dissipation systems.

- water body geometry
- other water use
- ecological considerations
- legislative restrictions.

The following steps should be considered by the reviewer as part of the initial environmental screening procedures for each system:

- Work through the EPM to consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies when needed to conduct this screening.

- Consult the appropriate NPDES administrative agencies to screen for those alternatives that will not meet CWA requirements.

- Establish any other justifiable environmental bases for rejection of a given alternative. When the reviewer rejects an alternative, that alternative needs no further consideration other than preparation of the reasons and justification for the rejection.

(1) Intake Systems—To analyze alternative intake systems, the reviewer should perform the following steps:

(a) Consult with the appropriate ESRP Chapter 4.0 and 5.0 reviewers to identify any mitigation measures or potentially superior alternative intake systems identified by these reviewers.

(b) Consider the following classes of alternatives:

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

(c) Consider the following environmental impacts and economic costs or factors for each mitigation measure and class of alternative:

- construction impacts

- impacts to aquatic ecology, including

  - entrapment
  - impingement
  - entrainment
  - other (site-specific) aquatic impacts.

- water-use impacts, including physical impacts resulting from hydrologic alterations (e.g., breakwater construction) and impacts resulting from siting on the floodplain[a]

- compliance with Federal, State, regional, local, and affected Native American tribal regulations or requirements

- capital cost, annual operating and maintenance costs, and total annual costs.

(d) Compare the proposed system with those remaining classes of alternatives not eliminated in an initial screening:

- Use a format similar to that shown in Table 9.4.2-1.

- Inputs for this table may be either absolute costs and benefits or incremental costs and benefits referenced to the proposed intake system.

- Additional factors may be included on a site- or system-specific basis.

(2) Discharge Systems—To analyze alternative discharge systems, the reviewer should perform the following steps:

(a) Consult with the appropriate ESRP Chapter 4.0 and 5.0 reviewers to identify any mitigation measures or alternative discharge systems suggested by these reviewers.

(b) Consider the following classes of alternatives:

- alternative discharge systems (e.g., submerged offshore vs. shoreline) and discharge type (e.g., slot, multiport)

- proposed system design modifications (e.g., modified discharge velocity, screens to prevent fish entry)

- alternative locations of proposed discharge system (e.g., up/downstream, alternative water body).

(c) Consider the following environmental impacts and economic costs or factors for each of the above classes of alternatives:

- construction impacts

(a) See ESRP 2.3.1 for a definition of the floodplain.

- impacts to aquatic ecology
- water-use impacts, including physical impacts of hydrological alterations and siting on the floodplain
- compliance with Federal, State, regional, local, and affected Native American tribal regulations or requirements
- capital costs, annual operating and maintenance costs, and total annual costs.

(d) Compare the proposed system with those remaining classes of alternatives not eliminated in an initial screening. Use a table format similar to that shown in Table 9.4.2-1.

(3) Water Supply Systems—To analyze alternative water supplies, the reviewer should perform the following steps:

(a) Consult with the appropriate ESRP Chapter 4.0 and 5.0 reviewers to identify any mitigation measures or alternative water supplies suggested by these reviewers.

(b) Consider as potential alternative water sources those water bodies within reasonable proximity to the proposed plant site that are capable of supplying plant water needs.

(c) When such water sources can be identified, compare them with the proposed water source using the following comparison factors:

- water body location and description
- estimated availability of water for plant use
- restrictions (if any) on water use for power plant cooling
- estimated aquatic, terrestrial, social, and environmental impacts associated with construction, operation, and maintenance of water transport systems from the water body to the plant
- 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.

(d) Use a format similar to that shown in Table 9.4.2-3 for this comparison. Data for this table may be prepared either as absolute benefits and costs or as incremental benefits and costs referenced to the proposed water source.

(4) Water Treatment System—To analyze water treatment systems, the reviewer should perform the following steps:

(a) Consider alternatives 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.

(b) Unless an adverse impact attributable to the proposed plant service water treatment system has been identified, restrict this analysis to alternative circulating water treatment systems.

(c) Consult with the reviewer for ESRP 3.3.3 to determine proposed water treatment systems and with the reviewer for ESRP 5.3.2.2 to determine potential impacts of discharged chemicals to aquatic biota.

(d) Consider the following classes of alternatives:

- alternative water treatment systems (e.g., mechanical vs. chemical)
- modifications to the proposed system (e.g., alternative chemicals, alternative discharge points)
- alternative operating procedures (e.g., shock treatment vs. continuous chemical addition, modified cooling tower concentration factors).

(e) Determine the following environmental and economic costs or factors for each of the above classes of alternatives:

- impacts to aquatic ecology (e.g., chemical toxicity)
- land-use impacts (e.g., evaporation ponds)
- water-use impacts (e.g., increased water use to achieve lower discharge chemical concentrations)
- compliance with Federal, State, regional, local, and affected Native American tribal regulations or requirements
- capital costs, annual operating and maintenance costs, and total annual costs.

(f) Compare the proposed system with those remaining classes of alternatives not eliminated in an initial screening. Use a format similar to that shown in Tables 9.4.2-1 and 9.4.2-5.

General Considerations

The reviewer should 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 should ensure that economic-cost data are available in sufficient detail to enable the reviewer to conduct benefit-cost balancing and comparisons with the proposed system, leading to a final staff conclusion for circulating water system consideration. The reviewer should 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 concurred with by the staff. For those alternatives eliminated from consideration on the basis of land-use, water-use, or other initial screening criteria, the reviewer should ensure that adequate documented justification for this action has been prepared.

If a mitigation measure or alternative circulating water system is to be considered, the reviewer should 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 could result in an equivalent or improved projected benefit-cost balance. When these criteria are met, the reviewer should verify those mitigation measures proposed by the reviewers for ESRP Chapters 4.0 and 5.0 or should identify the need for an alternative circulating water system. The reviewer should be guided by the following general considerations:

- The reviewer should 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 should allow for this when evaluating the comparative environmental impacts of each proposed alternative with those of the proposed system.

- The reviewer should 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.

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

- The evaluation of alternative circulating water systems should include consultation and coordination with those agencies responsible for NPDES administration. With the EPM as liaison, the reviewer should coordinate the evaluation of measures and controls to limit or avoid adverse impacts. When consulting through the EPM with the EPA, or with agencies of States that have memoranda of understanding with the NRC, the reviewer should ensure that the staff analyses and evaluations (1) are consistent with the details of these memoranda, (2) will serve the environmental impact statement needs of these agencies, and (3) are consistent with the requirements of the CWA.

Measures and Controls to Limit Adverse Impacts

When considering measures identified by the reviewers for ESRP Chapters 4.0 and 5.0 to mitigate adverse environmental impacts predicted for the proposed circulating water system, the reviewer's verification of the desirability of the measure should lead to the following conclusions:

- 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, regional, local, or affected Native American tribal regulations, requirements, or ordinances.

- The measure is consistent with NPDES restrictions.

Alternative Circulating Water Systems

The initial step in evaluating those alternative intake systems, discharge systems, water supplies, or water treatment systems identified by the analysis procedure of this ESRP should 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 should be applied to this evaluation:

- 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 CWA, the reviewer should conclude that there are no environmentally preferable alternatives. When this conclusion is reached, the reviewer should evaluate the alternatives to identify those that may be considered environmentally equivalent. For this condition, environmental equivalence means that an alternative has no unavoidable adverse impacts and meets CWA requirements. The reviewer should not indicate a preference between environmentally equivalent alternatives nor should a benefit-cost balancing be made when this condition prevails. Alternatives having unavoidable adverse environmental impacts or that do not meet CWA requirements should be judged environmentally inferior to proposed circulating water systems meeting these conditions.

- When the reviewer determines that the proposed circulating water system will meet CWA requirements, but is predicted to have unavoidable adverse environmental impacts, the reviewer should evaluate the identified alternative systems for potential environmental preference to the proposed system. The scope and extent of this evaluation should depend on the nature and magnitude of the proposed system's environmental impacts. An environmental review for the alternatives may be needed following the analysis and evaluation procedures of the appropriate ESRP Chapters 4.0 and 5.0. The following criteria apply to this evaluation:

- *Environmental preference will be established* when an alternative can be shown to have no unavoidable adverse impacts and will meet CWA requirements.

- *Environmental preference may be established* when an alternative that meets CWA 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 should involve consultation with the EPM and the appropriate ESRP Chapters 4.0 and 5.0 reviewers. This consultation should result in a joint determination of the status of any such alternative.

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

- *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 CWA requirements.

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

When environmentally preferable alternative circulating water systems have been identified, the reviewer should ensure that economic-cost data have been developed for the alternatives and that these data are adequate for a benefit-cost balancing and comparison with the proposed system. This portion of the evaluation procedure should be conducted with the assistance of appropriate reviewers for ESRPs 10.4.1 through 10.4.3. The reviewer should complete the economic and reliability portions of Table 9.4.2-1. On the basis of the completed table, the reviewer should 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 it should be considered as an alternative to the proposed system. For those cases in which 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 tentative conclusion that the alternative is superior should lead to consultation with the EPM and with the appropriate ESRP Chapter 4.0 and 5.0 reviewers. If this consultation establishes that the benefit-cost balances of such alternatives are no more than equivalent to the proposed system, the alternatives should not receive further consideration. When alternatives have significantly decreased benefits or increased economic costs, they should be rejected for any further consideration as alternatives to the proposed systems.

IV. EVALUATION FINDINGS

This section of the EIS should meet 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 relative to alternative circulating water systems.

The reviewer should prepare input describing the review and analysis of each alternative intake system, discharge system, water supply, and water treatment system. If desired, each input may be prepared as a separate EIS section (e.g., 9.4.2.1, "Alternative Intake Systems"). Each input to the EIS should 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 seeking environmentally preferable alternatives to the proposed system, and (4) the staff's conclusions for consideration of alternative systems.

The reviewer should discuss briefly those alternatives rejected because of specific deficiencies and should state why the alternative system was rejected. The reviewer should also identify those alternatives judged environmentally equivalent or inferior to the proposed system. The use of tables similar to Table 9.4.2-1 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.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

40 CFR 122, "EPA Administered Permit Programs: The NPDES Pollution Elimination System."

Coastal Wetlands, Planning Protection and Restoration Act of 1990.

Coastal Zone Management Act, as amended, 16 USC 1451 et seq.

Endangered Species Act, as amended, 16 USC 1531 et seq.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1251 et seq. (also known as Clean Water Act).

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

Marine Mammal Protection Act, as amended, 16 USC 1361 et seq.

Marine Protection, Research, and Sanctuaries Act, as amended, 33 USC 1401 et seq.

Memorandum of Understanding for the Regulation of Nuclear Power Plants Between NRC and the Army Corps of Engineers, 40 *Federal Register* 37110 (August 25, 1975).

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

Table 9.4.2-1. Comparison of Alternatives to the Proposed Intake System

	Proposed System	Alternative Systems	Design Modifications	Intake Locations	Operating Procedures
Construction Impacts					
Aquatic Impacts					
Water-Use Impacts					
Compliance with Regulations					
Total Annual Costs					

Table 9.4.2-2. Comparison of Alternatives to the Proposed Water Discharge System

	Proposed System	Alternative Systems	Design Modifications	Alternative Locations
Construction Impacts				
Impacts on Aquatic Ecology				
Water-Use Impacts				
Compliance with Regulations				
Total Costs				

Table 9.4.2-3. Comparison of Alternatives to the Proposed Water Supply

	Proposed Water Body	Alternative Water Body 1	Alternative Water Body 2	Alternative Water Body 3
Impacts to Aquatic Ecology				
Land-Use Impacts				
Water-Use Impacts				
Compliance with Regulations				
Total Costs				

Table 9.4.2-4. Comparison of Alternatives to the Proposed Water Treatment System

	Proposed System	Alternative Treatment System	System Modifications	Alternative Operating System
Chemicals Used (types and amounts)				
Impacts on Aquatic Ecology				
Land-Use Impacts				
Water-Use Impacts				
Compliance with Regulations				
Total Costs				

Table 9.4.2-5. Screening of Alternative Circulating Water Systems

Factors Affecting System Selection	Alternative 1	Alternative 2	Alternative 3
System description: Intake Discharge Water Supply Water Treatment			
Plant Water Requirements			
Land Land Relationship to Water Bodies Site Terrain Considerations			
Other Water Use			
Ecological Effects			
Legislative Restrictions			
Is this a suitable alternative circulating water system? (Yes/No)			

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

9.4.3 TRANSMISSION SYSTEMS

RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis of alternatives to the applicant's proposed transmission system. This includes evaluation of 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 should be compared with the proposed system on a benefit-cost basis to determine if any such system should be considered as a preferred alternative to the proposed system.[a]

The scope of the review directed by this plan should include (1) alternative corridor routes and (2) alternatives to proposed system design, construction, and maintenance practices. The review should 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 Federal regulations, and (3) can be judged as practical from a technical standpoint with respect to the proposed dates of plant operation. This review should 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 is the basis for staff conclusions with respect to the environmental preference or equivalence of alternative transmission systems and for environmentally preferable systems, and conclusions regarding any such systems having an equivalent or better benefit-cost balance than the proposed system.

(a) The review of environmentally preferable transmission systems should consider both the environment and economics; two or more reviewers may be needed to conduct this portion of the review.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 3.7. Obtain background information on the proposed transmission system siting and design.
- ESRPs 4.1.2, 5.1.2, and 5.6.3. Obtain input from these reviewers to obtain information regarding the environmental impacts and impacts to man from construction and operation of the proposed transmission system and corridors.
- ESRP 4.1.3. If the proposed construction of the transmission system and corridors is likely to result in adverse impacts to historic properties, obtain information regarding alternative locations for the system that may be taken into consideration.
- ESRPs 4.6 and 5.10. Provide, as appropriate, a list of those measures and controls to limit adverse transmission-system impacts that were developed as a result of this environmental review.
- ESRPs 5.6.1 and 5.6.2. Obtain a list of adverse impacts to the aquatic or terrestrial ecology from the transmission system that could be avoided or mitigated through alternative design or maintenance procedures.
- ESRP 5.8.3. If disproportionate adverse impacts on minority or low-income populations from transmission systems are identified, consider alternate designs, locations, or activities to avoid the impacts.
- ESRPs 10.1 and 10.4. Provide data and information to permit the inclusion of any suggested alternative to the proposed transmission system in the final evaluation of the proposed action.
- Interface with the Environmental Project Manager (EPM). Obtain input from the EPM when an alternative route or design appears to be environmentally preferable and meets regulatory requirements.

Data and Information Needs

The kinds of data and information needed will be affected by site- and region-specific factors, and the degree of detail should 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. Data or information should be obtained for the following alternatives:

(1) Alternative Corridor Routes

- 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 map detailing this information should be included in the environmental report (ER). Topographic maps (7½ or 15 min.) may be obtained from the applicant.

- 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 why they were not considered (e.g., system reliability) should be provided (from the ER and through consultation with agencies such as regional power pools).

- location and description of known populations of threatened or endangered species of plants and animals occurring along alternative corridors (through consultation with Federal, State, regional, local, and affected Native American tribal agencies)

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

- number and approximate location of known historic/archaeological sites within 2 km of the alternative corridor (from the ER and through consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- State and local laws or regulations that affect right-of-way acquisition, transmission line construction and operation, or corridor siting (from consultation with appropriate Federal, State, regional, local, and affected Native American tribal agencies)

Note: The following items should not be needed when the alternative route is an existing corridor containing towers and lines that will not be widened or require new towers for use as an alternative:

- maps or aerial photographs showing the approximate locations of national, State, or private wildlife 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 Federal, State, regional, local, and affected Native American tribal agencies)

- 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 the State and Federal departments of agriculture)

- corridor proximity to airports, roads, railroads, or other transportation facilities (from the ER)

- 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 agencies):

  - agricultural
  - forest, woodland
  - rangeland
  - recreational or ecologically sensitive areas such as parks, wildlife preserves/refuges or management areas, wetlands, wild and scenic rivers
  - urban or residential areas
  - commercial or industrial areas
  - other potentially significant classifications (e.g., Federally owned lands, Native American tribal lands, ethnic enclaves, or areas of high minority population)
  - potential geologic hazards (e.g., active faults) that could affect transmission system reliability.

(2) 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)
- alternative conductor designs (from the ER)
- underground placement in areas of potentially high impact (from the ER)
- 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 Federal, State, regional, local, and affected Native American tribal agencies)
- alternative maintenance practices (from the ER and through consultation with Federal, State, regional, local, and affected Native American tribal agencies)

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

- laws or regulations that affect transmission facility design or operation (from consultation with Federal, State, regional, local, and affected Native American tribal agencies).

(3) Selection Process and Cost Data

- 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-of-way (from the ER)

- 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 for principal alternatives (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of alternative transmission systems are based on the relevant requirements of the following:

- 10 CFR 51.71(a) referring to 10 CFR 51.45(a)(3) with respect to the need to discuss alternatives in the environmental analysis

- 10 CFR 51, Appendix A, with respect to discussion of alternatives to the proposed action

- 40 CFR 6.203 with respect to descriptions of size, location, land requirements, operation, and maintenance requirements of auxiliary structures such as transmission lines

- Regulatory requirements specific for particular land types (see Table 4.1.2-1)

- Executive Order 12898 with respect to Federal actions to address environmental justice in minority and low-income populations.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to evaluation of alternative systems designs

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998), with respect to site suitability guidelines

- U.S. Nuclear Regulatory Commission, "Alternative Electrical Transmission Systems and Their Environmental Impact," NUREG-0316, August 1977 (NRC 1977), with respect to environmental impacts.

Technical Rationale

The technical rationale for evaluating alternatives to the applicant's proposed transmission systems is discussed in the following paragraph:

> The consideration of alternatives is the essence of the NEPA process. The review conducted under this ESRP section contributes to the consideration of alternatives by addressing alternative means of power transmission to determine if there is an obviously superior system design or transmission corridor in terms of environmental impacts and economic costs when compared to the proposed system.

III. REVIEW PROCEDURES

The principal objectives of this analysis procedure are (1) to provide assistance to those ESRP Chapter 4.0 and 5.0 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.

The depth of the analysis should be governed by the nature and magnitude of proposed transmission-system impacts predicted by the ESRP Chapter 4.0 and 5.0 reviewers. When adverse impacts are predicted, the reviewer should coordinate 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) should 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 should 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 should 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 are identified, the review should be expanded to consider the economic costs of any such alternative. This analysis should be done in consultation with appropriate reviewers for ESRPs 10.4.1, 10.4.2, and 10.4.3. Assistance from these reviewers should be sought to establish the economic-cost data used to develop a benefit-cost comparison with the baseline (proposed) transmission system.

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

- transmission corridor routes
- design, construction, and maintenance.

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

The reviewer should 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 should not be considered in this initial screening. Working through the EPM, the reviewer may consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies when needed to conduct this screening. When the reviewer rejects an alternative, that alternative needs no further consideration other than the preparation 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 should initially consider only the environmental factors, and should 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 should be based on the environmental and economic factors shown in Table 9.4.3-1. The reviewer should 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 as follows:

(1) Alternative Corridor Routes

(a) The reviewer's analysis of alternative corridor routes should be based on a comparison of those routes with the proposed routes described in ESRP 3.7. The comparison may be made for complete routes or for route segments, as appropriate, and should consider those factors listed under the heading "Data and Information Needs" in this ESRP.

(b) The reviewer should consider both environmental and economic factors, using a tabular format similar to that shown in Table 9.4.3-1. The reviewer should consult with the reviewer for ESRP 3.7 and the appropriate ESRP Chapter 4.0 and 5.0 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 should involve the following:

Table 9.4.3-1. Comparison of Alternative Corridor Routes

Factor	Proposed Route or Segment	Alternative A Route/Segment	Alternative B Route/Segment
Descriptions New Corridors Total Length (km) Right-of-Way Width (m) Total Area (ha) Corridor Characteristics • As Appropriate from "Data Information Needs" in this ESRP • Others as Appropriate Existing (Cleared Corridors) Total Length (km) Right-of-Way Width (m) Total Area (ha)			
Impacts Land Use (e.g., agriculture, recreational areas) Terrestrial Ecology (e.g., habitat loss, endangered species) Aquatic Ecology (e.g., siltation, stream crossings) Socioeconomics (e.g., aesthetics, historic sites)			
Economic Factors Estimated Acquisition Cost Estimated Construction Costs Estimated Maintenance Costs Estimated Transmission Losses			

- Impacts—The reviewer should estimate the impacts that can be expected from development of alternative transmission corridors, tower and line installation, and operation and maintenance. The appropriate ESRP Chapter 4.0 and 5.0 reviewers should be consulted in making these estimates and in comparing these impacts with those predicted for the proposed corridor routes.

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

(2) Alternatives to the Proposed Transmission System Design, Construction, and Maintenance

(a) The reviewer's analysis of alternatives to the proposed system design, construction, and maintenance should be based on summaries made by the appropriate ESRP Chapter 4.0 and 5.0 reviewers for alternative actions to mitigate predicted impacts. As a general rule, these alternative designs, practices, and procedures will fall within the categories listed in "Data and Information Needs" in this ESRP. The following guidance should be considered when reviewing these alternatives:

- Alternative voltage levels and/or DC versus AC transmission should only be considered when (1) the reviewer for ESRP 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 (2) the alternatives are consistent with service area and regional transmission network characteristics.

- Alternative tower designs, tower heights, conductor-to-ground clearances, conductor designs, and right-of-way widths should be considered when the reviewers for ESRPs 5.6.1 through 5.6.3 predict adverse transmission system impacts (e.g., aesthetic impacts, electric fields, shock hazards) that could be mitigated by alternatives to these design parameters.

- Underground placement should be considered only for unusual circumstances in which the costs associated with this practice can be justified.

- Alternative construction practices should be considered when advised by the reviewers for ESRPs 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 construction activities.

(b) The reviewer should consider alternative maintenance practices, particularly with respect to corridor maintenance, when the proposed methods can be predicted to have adverse impacts

associated with, for example, herbicide drift or habitat loss due to clear cutting. The reviewer should consult with the reviewers for ESRPs 5.6.1 through 5.6.3 to determine the nature and scope of alternatives to be considered.

(c) The reviewer should consider alternative locations of auxiliary transmission system facilities only when the reviewers for ESRPs 4.1.2 or 5.1.2 advise relocating of such facilities.

Using the guidance below, the reviewer should evaluate the applicant's process for identifying and selecting alternative transmission system routes to ensure that reasonable alternatives to the proposed routes have been considered. The reviewer should also ensure that due consideration has been given to the use of existing transmission line corridors as an alternative to the development of new corridors. The reviewer should 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 is environmentally preferable, equivalent, or inferior to the proposed system.

For those alternatives determined to be environmentally preferable, the reviewer should ensure that economic-cost data are available in sufficient detail to enable the reviewer to conduct benefit-cost balance and comparisons with the proposed system, leading to a final staff recommendation for transmission system consideration. The reviewer should also ensure that all comparisons are made on the basis of the proposed system, as supplemented with those measures and controls to limit adverse impacts proposed by the applicant and concurred with by the staff. For those alternatives eliminated from consideration on the basis of land use, water use, or legislative restrictions, the reviewer should ensure that adequate documented justification for this action has been prepared.

(1) General Considerations

(a) If a mitigation measure or alternative transmission system is being considered, the reviewer should 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 could result in an equivalent or improved project benefit-cost balance. When these criteria are met, the reviewer should verify that those mitigation measures proposed by the reviewers for ESRP Chapters 4.0 and 5.0 will meet the criteria as a feasible alternative transmission system.

(b) The reviewer should 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 should allow for this when evaluating the comparative environmental impacts of each proposed alternative with those of the proposed system.

(c) The reviewer should 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.

(2) Measures and Controls to Limit Adverse Impacts

(a) When considering measures identified by the reviewers for ESRP Chapters 4.0 and 5.0 to mitigate adverse environmental impacts predicted for the proposed transmission system, the reviewer's verification of the desirability of the measure should reach the following conclusions:

- 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, regional, local, or affected Native American tribal regulations or ordinances.

(3) Alternative Transmission Systems

(a) The initial step in the evaluation of those alternative transmission systems identified by the analysis procedure of this ESRP should 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 should be applied to this evaluation:

- When the reviewer determines that the proposed system (with mitigation measures, if necessary) will have no unavoidable adverse impacts and will comply with applicable Federal, State, regional, local, and affected Native American tribal regulations or requirements, the reviewer should conclude that there is no environmentally preferable transmission system alternative. When this conclusion is reached, the reviewer should evaluate the alternatives to identify those that may be considered environmentally equivalent. For this condition, environmental equivalence means that an alternative has no unavoidable adverse impacts and meets applicable regulatory requirements. The reviewer should not indicate a preference between environmentally equivalent alternatives, nor should a benefit-cost analysis be made when this condition prevails. Alternatives having unavoidable adverse environmental impacts or that do not meet regulatory requirements should be judged environmentally inferior to proposed transmission systems meeting these conditions.

- When the reviewer determines that the proposed transmission system will meet regulatory requirements, but is predicted to have unavoidable adverse environmental impacts, the reviewer should evaluate the identified alternative systems for potential environmental preference to the proposed system. The scope and extent of this evaluation should depend on

the nature and magnitude of the proposed system's environmental impacts. An environmental review of the alternatives may be required following the analysis and evaluation procedures of the appropriate ESRP Chapters 4.0 and 5.0. The following criteria apply to this evaluation:

- *Environmental preference will be established* when an alternative can be shown to (1) have no unavoidable adverse impacts and (2) meet regulatory requirements.

- *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 should lead to consultation with the EPM and the appropriate ESRP Chapter 4.0 and 5.0 reviewers. This consultation should result in a joint determination of the status of any such alternative.

- *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.

- *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 Federal, State, regional, local, and affected Native American tribal regulations.

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

(b) When environmentally preferable alternative transmission systems have been identified, the reviewer should ensure that economic cost data have been developed for the alternatives and that these data are adequate for a benefit-cost balance and comparison with the proposed system. This portion of the evaluation procedure should be conducted with the assistance of reviewers for ESRPs 10.4.1, 10.4.2, and 10.4.3. The reviewer should complete the economic factors portions of Table 9.4.3-1. On the basis of the completed table, the reviewer should 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 considered as a replacement for the proposed system. For those cases in which 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 exceed those of the proposed system, a conclusion to further consider the alternative should lead to consultation with the Environmental Project Manager and with the appropriate ESRP Chapter 4.0 and 5.0 reviewers. If this conclusion establishes that the benefit-cost balances of such alternatives are no more than equivalent to the proposed system, the alternatives

should not be considered further. When alternatives have significantly decreased benefits or increased economic costs, they should be rejected for any further consideration as replacements for the proposed system.

IV. EVALUATION FINDINGS

Data for the EIS should meet 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.

The reviewer should prepare separate descriptions with respect to the review and analysis of each alternative route and alternative system design. If desired, each item may be prepared as a separate EIS section, (e.g., 9.4.3.1, Alternative Routes). Each item should 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 seeking environmentally preferable alternatives to the proposed system or component, and (4) the staff's conclusions. For alternative routes, the reviewers should also briefly describe the applicant's process for identifying and evaluating alternative routes and the staff's conclusion with respect to the merits of the procedure.

The reviewer should discuss briefly those alternatives rejected because of specific deficiencies and state why the alternatives were rejected. The reviewer should also identify those alternatives judged environmentally equivalent or inferior to the proposed system. The use of a table similar to Table 9.4.3-1 to present the staff's comparison of these potentially acceptable alternative transmission systems is recommended.

When the reviewer has concluded that an 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 should be included in the material to justify the alternative on an environmental and economic-cost basis.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

40 CFR 6.203, "Body of EISs."

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." 59 *Federal Register* (32): 7629-7633.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Alternative Electrical Transmission Systems and their Environmental Impact.* NUREG-0316, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations.* Regulatory Guide 4.7, Rev. 2, Washington, D. C.

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10.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the environmental consequences of the proposed action. The scope of the paragraph covered by this plan is to introduce the material from the reviews conducted under ESRPs 10.1 through 10.4.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's environmental consequences of the proposed action is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 10.1 through 10.4. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of a summary identification and description of the predicted adverse environmental impacts of plant or project construction and operation that cannot be avoided and for which no practical means of mitigation are available. The scope of the review directed by this plan should include (1) a tabulation of impacts identified by the staff as being adverse, (2) organization of these impacts by environmental categories, and (3) preparation of a summary describing the nature and magnitude of each category of impact.

The results of this review should be used to provide (1) a summary of those unavoidable adverse environmental impacts that will remain after all practical mitigation measures have been taken and (2) input to the final benefit-cost balancing of the project.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 4.6. Obtain lists of unavoidable adverse environmental impacts of plant construction and mitigation measures from this reviewer, which originate with reviewers of ESRPs 4.1.1 through 4.5.

- Section 5.10. Obtain lists of unavoidable adverse environmental impacts of plant operation and mitigation measures from this reviewer, which originate from the reviewers of 5.1.1 to 5.8.3.

- ESRPs 9.4.1 and 9.4.3. When the reviewers have identified a superior heat dissipation or transmission alternative that involves different land or other resource use, this information should be provided for evaluation of unavoidable adverse environmental impacts.

- ESRP 10.2. Provide a list of unavoidable adverse impacts that result in irreversible and irretrievable commitments of resources.

- ESRP 10.3. Provide a list categorizing the unavoidable adverse impacts of construction and operation as short term or long term.

- ESRP 10.4.2. Provide a list of unavoidable adverse impacts to be considered in the overall benefit-cost balancing.

Data and Information Needs

The kinds of data and information needed should be limited to descriptions of those predicted adverse impacts of project construction and operation identified by the reviewers of ESRP Chapters 4.0 and 5.0. The following data or information should be obtained:

- identification of adverse construction impacts and mitigation actions that the staff consider appropriate

- identification of adverse operational impacts and mitigation actions that the staff consider appropriate.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the evaluation of unavoidable adverse environmental impacts are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A, with respect to the identification of unavoidable adverse impacts to the environment.

Regulatory positions and specific criteria to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the content and presentation of material in an applicant's environmental report.

Technical Rationale

The technical rationale for evaluating the applicant's predicted unavoidable adverse environmental impacts is discussed in the following paragraph.

The NRC's environmental impact statement (EIS) represents the staff's findings related to the environmental consequences of the proposed action. It includes a description of the action, identification, and evaluation of the potential environmental impacts of the action, and evaluation of the alternatives. The review conducted for ESRP 10.1 leads to preparation of a summary of the staff's findings related to the unavoidable adverse impacts of the proposed action on the environment as required by 10 CFR 51, Appendix A(7).

III. REVIEW PROCEDURES

The reviewer's analysis and summary of adverse environmental impacts of construction and operation should be based on project design, construction, and operation (1) as proposed by the applicant and (2) which incorporates those measures and controls to limit adverse impacts that the staff consider appropriate. The reviewer should identify these impacts, organize them by environmental categories, and summarize each category for inclusion in the EIS. The following analysis procedure should be used:

(1) Consult with the reviewers for ESRPs 4.6 and 5.10, and obtain a list of adverse environmental impacts from project construction and operation.

(2) Organize these impacts as follows:

(a) staff identified adverse impacts of construction and operation based on the project as proposed by the applicant

(b) procedures and practices to mitigate or avoid these impacts

(c) unavoidable adverse impacts that remain after all practical means to avoid or mitigate the impact have been taken.

(3) Categorize the identified impacts according to the following format:

- land use
- hydrological and water use
- ecological
  - terrestrial
  - aquatic
- socioeconomic
- radiological
- atmospheric and meteorological
- environmental justice.

The categories may be further divided into construction and operational impacts if so desired.

(4) Prepare a table summarizing the procedure followed in Steps 2 and 3 above, identifying the ESRP that provides details of the staff analysis. The table will describe the nature and magnitude of the impact (see Table 10.1-1 for example).

(a) Determine the time scale of each impact (e.g., 4-6 months during construction, throughout the plant lifetime, indefinitely).

(b) Identify (for subsequent use by the reviewer for ESRP 10.2) any impacts that result in irreversible and irretrievable commitment of resources.

(c) Include (for the reviewer for ESRP 10.3) those impacts that are to be considered short term or long term.

(d) Consult with the appropriate ESRP Chapter 4.0 and 5.0 reviewers to ensure that adequate documentation, including applicant commitments to avoid adverse impacts, is available to support the staff conclusions regarding identification of each impact as adverse and unavailability of appropriate mitigating measures.

Table 10.1-1. Unavoidable Adverse Environmental Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
1. Land Use			
2. Hydrological and Water Use			
3. Ecological a. Terrestrial b. Aquatic			
4. Socioeconomic			
5. Radiological			
6. Atmospheric and Meteorological			
7. Environmental Justice			

(e) Ensure that each identified impact has been appropriately categorized. When a particular action or operation results in multiple impacts (e.g., access road construction and use may have impacts affecting land use, terrestrial ecology, and socioeconomics), ensure that the impacts are addressed in each appropriate category.

IV. EVALUATION FINDINGS

The environmental review for this ESRP should include identification of adverse operational impacts and mitigation actions that the staff consider appropriate.

The reviewer's summary of impacts will be the EIS input from the ESRP. The input should consist of a brief introductory paragraph and a table of impacts as shown in Table 10.1.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

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10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of a summary identification and description of the predicted irreversible and irretrievable[a] commitments of resources involved in project construction and operation that cannot be avoided by practical means. The scope of the review directed by this plan should include (1) a tabulation of all environmental resource commitments identified by the reviewers for ESRP Chapters 4.0 and 5.0 as being irreversible, (2) a tabulation of all materials used in plant construction and operation that are irretrievably committed, (3) organization of these commitments by category, and (4) preparation of a summary describing the nature and magnitude of each category of commitment.

The results of this review should be used to summarize those irreversible and irretrievable commitments of resources that should be input to the final benefit-cost balancing of the project.

(a) "Irreversible" applies to environmental resources and will concern commitments of the environment that cannot be altered at some later time to restore the present order of environmental resources. "Irretrievable" applies to material resources and will concern commitments of materials that, when used, cannot by practical means be recycled or restored for other use.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 4.6. Obtain lists of irreversible and irretrievable commitments of resources related to plant construction and originating from ESRPs 4.1.1 through 4.4.

- ESRP 5.10. Obtain lists of irreversible and irretrievable commitments of resources related to plant operation and originating from ESRPs 5.1.1 through 5.8.3.

- ESRPs 9.4.1 and 9.4.3. When the reviewers have identified a superior heat dissipation or transmission alternative that involves different land or other resource use, provide this information to the reviewer of ESRP 10.1 for evaluation of unavoidable adverse environmental impacts.

- ESRP 10.1. Obtain the list of unavoidable adverse environmental impacts.

Data and Information Needs

The kinds of data and information needed include descriptions of those irreversible commitments of environmental resources identified by the reviewers for ESRP Chapters 4.0 and 5.0 and those irretrievable commitments of material resources identified by the applicant. The following data or information should be obtained:

- unavoidable adverse environmental impacts (from the reviewer for ESRP 10.1)

- irreversible and irretrievable commitments of materials used in project construction and operation (from the environmental report [ER] and ESRPs 4.6 and 5.10).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the evaluation of irreversible and irretrievable commitments of resources are based on the relevant requirements of the following:

- 10 CFR 51.45(b)(5) and 10 CFR 51, Appendix A to Subpart A, with respect to consideration of irreversible and irretrievable commitment of resources.

Regulatory positions and specific criteria to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the content and presentation of material in an applicant's ER.

Technical Rationale

The technical rationale for the evaluation of the applicant's predicted irreversible and irretrievable commitments is discussed in the following paragraph:

The NRC's environmental impact statement (EIS) represents the staff's findings related to the environmental consequences of the proposed action. It includes a description of the action, identification, and evaluation of the potential environmental impacts of the action, and evaluation of the alternatives. ESRP 10.1 summarizes the unavoidable adverse impacts of the proposed action. The review conducted for ESRP 10.2 leads to preparation of a summary of the staff's findings related to the irreversible and irretrievable commitment of resources of the proposed action as required by 10 CFR 51, Appendix A to Subpart A.

III. REVIEW PROCEDURES

The reviewer's analysis and summary of irreversible and irretrievable commitments of resources should consist of two sections: (1) irreversible environmental commitments (e.g., land-use productivity) predicted by the reviewers for ESRP Chapters 4.0 and 5.0, and (2) irretrievable material resources (e.g., steel) identified by the applicant as proposed for use in project construction and operation. The reviewer should identify these commitments and summarize them for inclusion in the EIS. The following analysis procedure should be used:

(1) Consult with the reviewers for ESRP Chapters 4.0 and 5.0 and obtain a list of irreversible commitments of environmental resources based on the applicant's proposed project and the project with appropriate measures to limit and control adverse impacts.

(2) Organize these commitments as follows:

- staff identified commitments based on the project as proposed by the applicant
- procedures and practices to minimize or avoid these commitments
- unavoidable commitments that remain after all practical means to avoid or minimize the commitments have been taken.

(3) Identify those materials (e.g., steel, concrete, uranium) that should be irretrievably committed during construction and operation of the plant.

- Use the table format example shown in Table 10.2-1.
- Analysis may be based on a standard (e.g., 1000 MWe) reactor size.
- Modify the table on the basis of site- and plant-specific materials data supplied by the applicant.

(4) Consult with the reviewer for ESRP 10.1 and with appropriate ESRP Chapters 4.0 and 5.0 reviewers to ensure that staff conclusions with respect to the irreversibility of environmental commitments are appropriate and can be supported.

(5) Consider irreversible commitments as they may apply to the following categories:

- land use
- hydrological and water use
- ecological
  - terrestrial
  - aquatic
- socioeconomic
- radiological
- atmospheric and meteorological.

(6) Ensure that the irretrievable commitments of material resources identified by the applicant are reasonable and consistent with the basic data of Table 10.2-1.

(7) Ensure that any other material resources identified by the reviewers of ESRP Chapters 4.0 and 5.0 have been included.

- Permanent resource commitments include land and uranium.

- The generic table provided in 10 CFR 51.51 identifies the environmental effects of the uranium fuel cycle for inclusion in the utilities' environmental report and provides information about uranium and related resources used in making nuclear fuel.

(8) Ensure that the statement in the "Evaluation Findings" of this ESRP, with respect to uranium availability, has been updated to reflect current U.S. Department of Energy (DOE) resource analyses.

IV. EVALUATION FINDINGS

The reviewer should prepare a summary of irreversible and irretrievable commitments of resources as the EIS input. The input should consist of a brief paragraph describing any environmental commitments and a table similar to Table 10.2-1 describing material commitments. The reviewer should include the following statement, updated as necessary to reflect the current DOE resource analysis:

> U.S. Department of Energy resource estimates indicate that sufficient uranium resources exist in the United States to fuel all operating reactors, reactors under construction, and reactors being planned for the next 10 years at a U_3O_8 cost (1996 dollars) of $30.00/lb or less. These quantities of uranium can be supplied from the resource categories designated as reserves and estimated additional resources, the two most certain resource categories (EIA 1997).

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.45, "Environmental report."

10 CFR 51.51, "Uranium fuel cycle environmental data—Table S-3."

Energy Information Administration (EIA). 1997. *Uranium Industry Annual 1996*, DOE/EIA-0478(96), U.S. Department of Energy, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

Table 10.2-1. Estimated Quantities of Materials Irretrievably Committed to the Construction and Operation of a 1000-MWe Nuclear Power Plant

Material	Quantities Used[a]	U.S. Reserves[b]
Aluminum		
Asbestos		
Boron		
Concrete		
Titanium		
Tungsten		
Uranium		
Zinc		

(a) Reference document for quantity used.
(b) Reference document for reserves data.

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10.3 RELATIONSHIP BETWEEN SHORT TERM USES AND LONG TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and summarization of the proposed project's local short term uses of the environment and the effects of these uses on long term environmental productivity.

The scope of the review directed by this plan should include an analysis of the predicted short term unavoidable adverse environmental impacts (or environmental benefits) of plant construction and operation and the predicted long term environmental impacts (or benefits) resulting from plant construction and operation. For the purposes of this ESRP, "short term" will represent the period from start of construction to end of plant life, including prompt decommissioning, and "long term" will represent the period extending beyond the end of plant life, including the period up to and beyond that required for delayed plant decommissioning. The review should also include an evaluation of the extent to which the proposed project's use of the environment will preclude any options for other future use of the environment.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 4.1 through 4.6. Obtain input on those other uses of the environment that will be precluded by plant construction.

- ESRPs 5.1 through 5.10. Obtain input on those other uses of the environment that will be precluded by plant operation.

- ESRP 10.1. Obtain the list of unavoidable adverse environmental impacts.

- ESRP 10.2. Obtain the list of irreversible and irretrievable commitments of resources.

Data and Information Needs

The kinds of data and information needed will be the unavoidable adverse environmental impacts of plant construction and operation and the irreversible and irretrievable commitments of resources that represent short-term and long-term use of the human environment. The following data or information should be obtained:

- adverse impacts of construction and operation (from ESRP 10.1)

- irreversible and irretrievable commitment of resources (from ESRP 10.2).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the evaluation of short term uses and long term productivity are based on the relevant requirements of the following:

- 10 CFR 51.45(b)(4) and 10 CFR 51, Appendix A, with respect to consideration of the relationship between short-term uses and long-term productivity of the human environment.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to the content and presentation of material in an applicant's environmental report.

Technical Rationale

The technical rationale for evaluating the applicant's described relationship between short-term uses and long-term productivity of the human environment is discussed in the following paragraph:

> The NRC's environmental impact statement (EIS) represents the staff's findings related to the environmental consequences of the proposed action. It includes a description of the action, identification, and evaluation of the potential environmental impacts of the action, and evaluation of the alternatives. Input from ESRPs 10.1 and 10.2 are used in the EIS to summarize the unavoidable adverse impacts and the irreversible and irretrievable commitment of resources of the action. The

review conducted for ESRP 10.3 leads to the staff's findings related to the relationship between short-term uses and long term productivity of the environment as required by 10 CFR 51, Appendix A(7).

III. REVIEW PROCEDURES

The reviewer's analysis of the relationship between short term uses and long term productivity should be based on the tabulation of unavoidable adverse environmental impacts and irreversible and irretrievable commitments of resources prepared by the reviewers for ESRPs 10.1 and 10.2 using the following steps:

(1) Consider that an occupation of land by plant structures for an indefinite period represents the maximum impact on long term productivity, unless other long term preemptions have been identified by these reviewers.

(2) Identify through consultation with the appropriate ESRP Chapters 4.0 and 5.0 reviewers those other uses of the environment that will be precluded by plant construction and operation (e.g., loss of productive farmland) and that will classify these as either short term or long term preemptions.

(3) Determine how any short term or long term benefits of the proposed project, as identified by appropriate ESRP Chapters 4.0 or 5.0 reviewers, affect any such preemptions.

(4) As necessary, consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies to make these determinations.

(5) Evaluate the project's impact on short term use and long term productivity capabilities of the environment and determine if the EIS input statement given below is accurate and applicable.

IV. EVALUATION FINDINGS

Unless the reviewer has identified other long term environmental impacts, the following input to the EIS should be used:

- The local use of the human environment by the proposed project can be summarized in terms of the unavoidable adverse environmental impacts of construction and operation and the irreversible and irretrievable commitments of resources. With the exception of the consumption of depletable resources as a result of plant construction and operation, these uses may be classed as short term. The principal short term benefit of the plant is represented by the production of electrical energy; and the economic productivity of the site, when used for this purpose, will be extremely large compared with the productivity from agriculture or from other probable uses for the site.

- The maximum long term impact to productivity will result when the plant is not dismantled at the end of the period of plant operation, and consequently the land occupied by the plant structures will not be available for any other use. However, the enhancement of regional productivity resulting from the electrical energy produced by the plant is expected to result in a correspondingly large

increase in regional long term productivity that would not be equaled by any other long term use of the site. In addition, most long term impacts resulting from land-use preemption by plant structures can be eliminated by removing these structures or by converting them to other productive uses.

- The staff concludes that the negative aspects of plant construction and operation as they affect the human environment are outweighed by the positive long term enhancement of regional productivity through the generation of electrical energy.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51, Appendix A(7), "Environmental consequences and mitigating actions."

10 CFR 51.45, "Environmental report."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

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10.4 BENEFIT-COST BALANCE

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of an introductory paragraph for the portion of the environmental impact statement (EIS) that describes the benefit-cost balance. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 10.4.1 through 10.4.3.

Review Interfaces

None.

Data and Information Needs

The reviewer for this ESRP should obtain the proposed organizational structure of the EIS from the Environmental Project Manager.

II. ACCEPTANCE CRITERIA

The reviewer should ensure that the introductory paragraph prepared under this ESRP is consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear, analytic, and written in plain language.

Regulatory positions and specific criteria necessary to meet the Commission's regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP.

Technical Rationale

The technical rationale for evaluating the applicant's description of benefit-cost balance is discussed in the following paragraph:

Introductory paragraphs that orient the reader with respect to the relevance of the material to the overall organization and goals of the EIS add clarity to the presentation.

III. REVIEW PROCEDURES

The material to be prepared is informational in nature, and no specific analysis of data is required.

IV. EVALUATION FINDINGS

The reviewer of information covered by this ESRP should prepare at least one introductory paragraph for the EIS. The paragraph(s) should introduce the nature of the material to be presented by the reviewers of information covered by ESRPs 10.4.1 through 10.4.3. The paragraph(s) should list the types of information to be presented and describe their relationships to information presented earlier and to be presented later in the EIS.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCE

10 CFR 51.70, "Draft environmental impact statement—general."

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10.4.1 BENEFITS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and tabulation of the benefits resulting from proposed project construction and operation. The reviewer may rely on an independent analysis of benefits by State or regional authorities, the applicant's analysis, or prepare an independent assessment. If a review of the applicant's analysis is conducted, the reviewer should ensure that the applicant's assumption, data, and methods have been accepted by all reviewers for ESRP Chapters 3.0, 5.0, 7.0, 8.0, and 9.0. If reviewers have provided an independent analysis, the review in this ESRP should be modified accordingly. The scope of the review directed by this plan should include the plant average annual electrical-energy generation in kilowatt-hours (kWh), enhanced reliability of the electrical distribution system, technical benefits such as development of technology, the quantities of other products (e.g., steam) produced, and other benefits (e.g., increased regional productivity, tax revenues, new or improved recreational facilities) identified in previous environmental reviews. Benefits should be identified for the applicant's proposed project and for any alternatives identified as appropriate and practical to mitigate predicted environmental impacts.

The benefits of plant construction and operation should be summarized in tabular form similar to that shown in Table 10.4.1-1. Each benefit identified by the reviewer should be discussed in the text and presented in the table.

Table 10.4.1-1. Benefits of the Proposed Project

Benefit Category	Project as Proposed	With Option 1	With Option 2
Description of Project	As Proposed	[Short Description]	[Short Description]
Monetary Benefits			
Net Electrical Generating Benefits			
Average Production of Other Commercial Products State and Local Tax Payments During Construction/Refurbishment During Operations			
Effects on Regional Productivity (specify)			
Technical and Other Nonmonetary Benefits (specify) Technical Development Recreational Facilities			
Esthetic Values Environmental Enhancement Improvements to Local Facilities			
Other			

Review Interfaces

The reviewer for this ESRP will obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 3.2. Obtain data on net electrical generating benefits and other commercial products.
- ESRPs 4.4.2 and 5.8.2. Obtain data on annual tax payments and incremental increases in regional productivity.
- ESRPs 4.1.1 through 5.8.3. Obtain data on all non-monetary benefits.

- ESRP 8.4. Obtain conclusions and analysis for assessment of need.

- ESRP 9.3. Obtain data on differences in benefits (if any) among sites.

- ESRPs 9.4.1 through 9.4.3. Obtain data on differences in benefits (if any) among systems configurations.

- ESRP 10.4.3. Provide input as required to conduct and present the final benefit-cost balance for the proposed project.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- the net electrical generating benefits of the proposed plant (from ESRP 3.2)

- the average annual production of other commercial products (from ESRP 3.2)

- expected annual tax payments to local and State governments (1) for the construction period and (2) during plant operation (from ESRPs 4.4.2 and 5.8.2)

- incremental increase in regional productivity (1) during the construction period and (2) during the operation period or during the renewal period (from ESRPs 4.4.2 and 5.8.2)

- those technical (e.g., technology development) and nonmonetary benefits (e.g., new recreational facilities) identified by the reviews for ESRP Chapters 4.0 and 5.0.

II. ACCEPTANCE CRITERIA

Acceptance criteria of the analysis of benefits are based on meeting the relevant requirements of the following:

- 10 CFR 51.45(d) and 51.71(d) with respect to the analyses required in the development of the environmental report (ER) and environmental impact statement (EIS)

- 10 CFR 52.18 with respect to reviewing applications for early site permits

- 10 CFR 52.81 with respect to reviewing applications for combined licenses

- 10 CFR 54.23 with respect to applications for license renewal.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to information needs and formats for benefit-cost balancing.

Technical Rationale

The technical rationale for evaluating the applicant's described benefits is discussed in the following paragraphs:

In accordance with 10 CFR 51.45(d), the applicant should submit in the ER information needed for evaluating these factors. Similar information is required to be present in the EIS pursuant to 10 CFR 51.71.

Reasonably detailed information about the economic benefits of the proposed action is needed to assess any potential social or economic impacts that might occur as a result of plant construction or operation. Data in the ER should be adequate to make these determinations. With open access to transmission, it will not always be apparent where electrical generating benefits will occur or how they will be identified. The reviewer should carefully review the applicant's analysis and be familiar with current utility Commission practice and policy.

III. REVIEW PROCEDURES

To determine benefits, the reviewer should perform the following steps:

(1) Ensure that all appropriate plant production benefits have been identified and quantified. Ensure that quantification of these benefits is correct and is consistent with the staff's findings in ESRP 8.4.

(2) For other benefits, ensure the following:

- All relevant benefits have been identified and established.
- The quantification of each benefit is appropriate.
- The relative significance of each benefit has been established and is appropriate to the impact.

Benefits should be described in a tabular format similar to Table 10.4.1-1. Extra columns and rows may be added as needed.

(3) Base benefits on the description of the project as proposed by the applicant, including post application modifications made in response to staff assessments of measures to mitigate predicted environmental impacts.

If staff identified alternatives have not been adopted by the applicant, identify and analyze benefits for the project as proposed by the applicant.

(4) Determine electricity generation and other plant-production benefits (e.g., steam production).

(5) Identify and tabulate the other benefits of project construction and operation in consultation with the reviewers for ESRP Chapters 3.0, 4.0, and 5.0. Identify other benefits listed in the applicant's ER and ensure that these potential benefits have been considered by the appropriate staff reviewer(s). These benefits include the following:

- technical development
- State and local tax revenues
- incremental increase in regional productivity
- enhancement of recreational values
- enhancement of aesthetic values
- environmental enhancement
- creation and improvement of local roads or other facilities
- intangible benefits (e.g., reduced dependence on scarce fossil fuels).

(6) Quantify benefits in monetary or other appropriate terms whenever possible and determine their significance on a political boundary or regional basis.

When quantification of these benefits is not possible, make a qualitative assessment.

IV. EVALUATION FINDINGS

The reviewer should verify that sufficient information has been provided in accordance with the requirements of this ESRP section and that the evaluation supports the following type of concluding statement, to be included in the staff's EIS:

The staff reviewed the available information relative to the economic benefits of the proposed action. The staff concludes that the information is adequate to satisfy the requirements of 10 CFR 51.45 and the intent of 10 CFR 51.71.

These conclusions are based on the following:

- The applicant has developed the information using information sources and approaches suggested by prevailing professional practice.

- The information sources used are recently updated versions.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 52.18, "Standards for review of applications."

10 CFR 52.81, "Standards for review of applications."

10 CFR 54.23, "Contents of application—environmental information."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

10.4.2 COSTS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and evaluation of the internal and external costs of construction and operation of the proposed project. The reviewer may rely on an independent analysis of benefits by State or regional authorities or the applicant's analysis. An independent assessment may also be prepared. If a review of the applicant's analysis is conducted, the reviewer must ensure that the applicant's assumption, data, and methods have been accepted by reviewers for ESRP Chapters 3.0, 5.0, 7,0, 8.0, and 9.0. If reviewers have provided the independent analysis, the review in this ESRP should be modified accordingly. The scope of the review directed by this plan should include (1) capital costs, fuel costs, operating and maintenance costs, decommissioning costs, and any other identified internal costs, (2) the external costs of impacts (e.g., loss of productivity, loss of wildlife habitat) identified in previous environmental reviews, and (3) other external costs not associated with an identified environmental impact. Costs should be identified for the applicant's proposed project and for any staff-identified alternatives to mitigate adverse impacts. Primary reliance should be placed on quantitative estimates where possible.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRPs 3.2 through 3.8. Obtain data relative to the proposed system configuration and costs.
- ESRPs 4.1.1 through 5.8.3. Obtain data relative to the external costs of the project.

- ESRPs 6.1 through 6.7. Obtain data relative to the costs of monitoring systems.
- ESRPs 7.1 through 7.3. Obtain data relative to the costs of postulated accidents.
- ESRP 8.4. Obtain a summary of the benefit-cost balancing related to insufficient baseload capacity or adding capacity too soon.
- ESRPs 9.4.1 through 9.4.3. Obtain data relative to the costs of the proposed facility, together with modifications identified by staff.
- ESRPs 10.1 and 10.2. Obtain data relative to the irreversible impacts and commitments of resources.
- ESRP 10.4.3. Provide input as required to conduct and present the final benefit-cost balance for the proposed project.

Data and Information Needs

This part of the environmental review represents the final summation of all costs, either monetary or environmental (including social), that are predicted for the proposed project and for staff identified alternatives. Consequently, all portions of the environmental review associated with these costs should be considered by the reviewer of this section. The following data or information should be obtained:

- predicted impacts of construction (from ESRP Chapter 4.0)
- predicted impacts of operation (from ESRP Chapter 5.0)
- costs of the alternative modifications and additions to the site preparation and construction monitoring programs and preoperational monitoring programs, if any (from ESRP 6.7)
- the environmental impacts of postulated accidents (from ESRP Chapter 7.0)
- construction and operating costs (from ESRP 9.4)
- costs associated with the staff analysis of the relationship between short-term uses and long-term productivity (from ESRP 10.2)
- costs associated with any irreversible and irretrievable commitments of resources (from ESRP 10.3).

II. ACCEPTANCE CRITERIA

Acceptance criteria of the analysis of costs are based on meeting the relevant requirements of the following:

- 10 CFR 51.45(d) and 51.71(d) with respect to the analyses required in the development of the environmental report (ER) and environmental impact statement (EIS)
- 10 CFR 52.18 with respect to reviewing applications for early site permits
- 10 CFR 52.48 with respect to reviewing applications for standard design certifications
- 10 CFR 52.81 with respect to reviewing applications for combined licenses.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to information needs and formats for a benefit-cost balancing

Technical Rationale

The technical rationale for evaluating the applicant's proposed costs is discussed in the following paragraphs:

In accordance with 10 CFR 51.45(d), the applicant is required to submit, in the preliminary and final ERs (PER and FER), information needed for evaluating these factors. Similar information is required to be present in the EIS pursuant to 10 CFR 51.71.

Reasonably detailed information about the economic benefits of the proposed action is needed to assess any potential social or economic impacts that might occur as a result of plant construction or operation. Data in the ER must be adequate to assist the staff in making these determinations.

III. REVIEW PROCEDURES

The internal and external costs to be considered by the reviewer should be based on the project as proposed by the applicant and with modifications identified by staff to mitigate and control predicted adverse impacts. Internal and external costs should be described using the following procedures:

Internal Costs

(1) Describe each identified internal cost and outline the method used to obtain the described value (e.g., present worth cost).

- Reference to other EIS sections may be made (when appropriate) to present the basis for the staff analysis.

(2) List costs, using the format shown in Table 10.4.2-1.

- Where the information to be presented would be included in the table described in ESRP 10.4.3, you may reference that table instead of repeating the information in the table for this section.
- Internal costs include capital costs (including the capital cost of added transmission lines), operating and maintenance costs, fuel costs, and decommissioning costs.
- Other costs may be classified as internal, when appropriate.
- Express all internal costs, either provided by the applicant or estimated by the staff, in monetary terms.
- For all internal costs, determine the present worth cost and levelized annual equivalent cost.
  - Express present worth costs in dollars of the first year of commercial operation of the first unit.
  - Express annual costs in dollars per year and mills per kilowatt-hour for the first year of commercial operation of the first unit.

(3) Use methods and economic assumptions consistent with those used in ESRP 9.4, and use the results of calculations presented by the reviewer of ESRP 9.4 when available.

(a) Where plant capacity affects a value of an internal cost, determine the cost for both the high and low extremes of the range of plant-capacity factors assumed in the review for ESRP 9.4.

(b) Sum the present worth values of the internal costs to arrive at a total present worth internal cost of the proposed project.

(4) Ensure that appropriate internal costs have been identified and quantified, and ensure that quantification of these costs is correct and consistent.

External Costs

(1) Describe each external cost associated with an environmental impact, reference the corresponding environmental statement section, and describe or reference the method used to develop the cost data.

- For quantified costs, show the relationship (significance) of the cost to the regional value of the impacted parameter.
- Where costs cannot be quantified, estimate the significance of the cost as it relates to regional values.

Cost data may be presented in tabular form or referenced to an equivalent table (if provided) for ESRP 10.4.3.

(2) Determine the external costs of project construction and operation in consultation with the reviewers of ESRP Chapters 4.0, 5.0, 6.0, and 7.0.

- Identify and tabulate each unmitigated adverse impact and determine its cost.
- Consider the costs of mitigated adverse impacts and appropriately assign these as internal or external costs.
- Quantify costs in monetary or other appropriate terms whenever possible, and determine the significance of this cost on a regional[a] basis.
  - If monetary terms can be applied, calculate them for the same time (year) selected for the internal-cost analysis.
  - If external costs cannot be quantified, present qualitative cost estimates for each such impact.

The following typical cost terms (shown for a loss of offsite agricultural production) might be used:

Monetary: "Annual loss of $4000.00 to soybean producers. The annual regional value of this crop to producers is $200,000.00."

Quantitative: "Annual loss of 50 hectares of soybean cropland. The regional cropland used for soybean production averages 300 hectares."

Qualitative: "Moderate impact to regional production of soybeans."

(a) See ESRPs 2.2.3 and 2.5.2 for definitions of "region."

(3) For external costs, ensure the following:

- Adverse impacts requiring mitigation or avoidance have been identified.
- The cost value assigned to each impact is appropriate.
- The relative significance of each cost has been established and is appropriate to the impact.
- All unavoidable adverse environmental impacts identified in ESRP 10.1 have been considered and assigned cost values.
- All other external costs (e.g., resource commitments) not associated with an identified environmental impact have been considered.

(4) Ensure that any transfer payment (e.g., tax) listed as a benefit in ESRP 10.4.1 has a corresponding cost considered in this section.

(5) If costs of measures and controls to mitigate, or alternatives to avoid, environmental impacts have been considered, ensure that all such costs have been presented in a manner that permits their direct comparison with corresponding costs of project elements as proposed by the applicant.

(6) If alternatives have been analyzed, prepare a cost comparison for these alternatives and the applicant's proposal.

- Reference the appropriate EIS section describing the impact and ESRP 9.4 analyses comparing the applicant's proposal and the alternative(s).

IV. EVALUATION FINDINGS

Direct the input to this section of the EIS toward accomplishing the following objectives: (1) public disclosure of the costs of the proposed project, (2) presentation of the basis for the staff analysis, and (3) presentation of the staff conclusions as to the relative significance of the costs.

The reviewer should verify that sufficient information has been provided in accordance with the requirements of this ESRP section and that the evaluation supports the following type of concluding statement, to be included in the staff's EIS:

> The staff reviewed the available information relative to the economic benefits of the proposed action and concludes that the information is adequate to satisfy the requirements of 10 CFR 51.45 and the intent of 10 CFR 51.71. These conclusions are based on the following:
>
> - The applicant has developed the information using information sources and approaches suggested by prevailing professional practice.

- The information sources used are recently updated versions.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 52.18, "Standards for review of applications."

10 CFR 52.48, "Standards for review of applications."

10 CFR 52.81, "Standards for review of applications."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

Table 10.4.2-1. Internal and External Costs of the Proposed Project

Cost Category	Project as Proposed	With Option 1	With Option 2
Describe Option	As Proposed	[Description]	[Description]
INTERNAL COSTS			
Land			
Labor			
Materials			
Equipment			
Services			
Indirect (e.g. Overhead)			
EXTERNAL COSTS			
Land Use			
Hydrological and Water Use			
Terrestrial Biology			
Aquatic Biology			
Socioeconomic			
Other (specify)			

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10.4.3 SUMMARY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis, evaluation, and balancing of the benefits and costs of the proposed project leading to a final decision as to the acceptability of the project (1) as proposed by the applicant or (2) as proposed by the applicant with modifications identified by the staff. The reviewer may rely on an independent analysis of benefits by State or regional authorities, rely on the applicant's analysis, or prepare an independent assessment. If the applicant's analysis is reviewed, the reviewer must ensure that the applicant's assumption, data, and methods have been accepted by all reviewers for ESRP Chapters 3.0, 5.0, 7.0, 8.0, and 9.0. If reviewers have provided the independent analysis, the review in this ESRP should be modified accordingly.

The scope of the review directed by this plan includes construction and operating benefits and costs. If staff alternatives have been identified to mitigate or avoid adverse environmental impacts, the reviewer of this section should analyze, evaluate, and balance the costs of each such alternative against the environmental improvements achieved to reach a decision as to disposition of the recommendation. The final balancing will be of the proposed plant design as requested by the applicant with the modifications deemed to be cost beneficial.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 8.4. Obtain a summary of the benefit-cost balancing dealing with the consequences of not having enough electric power or having it too soon.

- ESRPs 9.1 through 9.4. Obtain information from these plans on the alternatives under serious consideration and the economic costs of any environmentally preferable options.

- ESRP 10.4.1. As a part of the review of ESRP 10.4.1, provide a tabulation of the benefits to be derived from the proposed project. These data should be made available for the analysis in this ESRP.

- ESRP 10.4.2. As a part of the review of ESRP 10.4.2, provide a tabulation of the environmental costs of the project as proposed by the applicant, including all commitments made in the most recent amendments to the applicant's environmental report (ER). These data should be made available for the analysis in this ESRP.

- Interface with Environmental Project Manager (EPM). Obtain input from the EPM on the benefit-cost balance for updated project insights, if any, relevant to this summary.

Data and Information Needs

The part of the environmental review represented by this section of the environmental impact statement (EIS) is the culmination of the entire review effort. Thus, the information required by the reviewer to conduct this analysis should be full knowledge of the analysis conducted to support each individual section of the environmental review.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the benefit-cost summary of the proposed action are based on meeting the relevant requirements of the following:

- 10 CFR 51.45(d) and 51.71(d) with respect to the analyses required in the development of the ER and EIS

- 10 CFR 52.18 with respect to reviewing applications for early site permits

- 10 CFR 52.81 with respect to reviewing applications for combined licenses

- 10 CFR 51.95(c)(4) with respect to decision criteria for a record of decision.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev.2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to information needs and formats for benefit-cost balance.

Technical Rationale

The technical rationale for evaluating the applicant's summary of benefit-cost balance is discussed in the following paragraph:

> Summary information about the economic costs and benefits of the proposed action is required to determine the positive or negative direction of social or economic net impacts that might occur as a result of plant construction or operation. Data provided in the ER must be adequate to assist the staff in making these determinations.

III. REVIEW PROCEDURES

This benefit-cost balancing should be conducted under the direction of those most knowledgeable of the entire project, the EPM, and the review team leader in concert with each individual reviewer. The reviewer may evaluate the benefit-cost balancing prepared by the applicant or may conduct such balancing independently.

The reviewer should do the following steps:

(1) Tabulate the benefits to be derived from the proposed project. This was done as a part of the review of ESRP 10.4.1.

(2) Analyze the benefits in terms of megawatt-hours of electrical energy generated, megawatts of capacity, and less tangible benefits such as recreational or educational facilities resulting from the proposed project. Consider the benefits of the project as modified by suggested alternatives that have not been adopted by the applicant.

(3) Tabulate the environmental costs of the project as proposed by the applicant, including all commitments made in the most recent amendments to the applicant's ER. This was done as a part of the review of ESRP 10.4.2.

- This tabulation should include costs for each of the environmental impacts and other costs determined by the reviewer for ESRP 10.4.2.

- This should also include the environmental costs of alternatives for measures and controls to mitigate adverse impacts that have not been adopted by the applicant.

(4) Consider the following characteristics of each environmental cost in this analysis:

- the environmental effect
- the impact expected, quantified if possible
- the relative significance of the cost and impact as compared to similar resources available in the region, quantified if possible.

(5) Consider any environmentally preferable alternative identified by the reviewers for ESRPs 9.2 and 9.3 (which, if adopted by the staff, would imply recommended denial of the application to construct a nuclear power plant).

- Provide the benefit-cost balance for these alternatives to determine if any may be considered as obviously superior to the proposed project.
- Similarly assist the reviewers for ESRP 9.4 to determine if any environmentally preferable alternative plant or transmission-system component would have a benefit-cost balance that warrants its being recommended as an alternative to the proposed component.

(6) Review the tabulation of the staff's assessments of the environmental costs and benefits of the project as proposed by the applicant and establish the reasonableness, accuracy, and completeness of the tabulation. This tabulation forms the baseline from which the acceptability of costs and benefits of additional requirements should be established.

(7) Review the modifications identified by the staff in terms of absolute and relative environmental improvement and absolute and relative additional cost to the utility and community.

(8) Express the environmental modifications and costs in various manners and units to ensure that the relative significance is expressed in the most useful perspective for decisionmaking.

- If the environmental improvements are determined to be cost beneficial, note this in the tabulation along with any conditions to be included in the summary and conclusions section of the EIS.
- If the environmental improvement is determined to be not cost-beneficial, the affected sections of the EIS should be written to reflect this conclusion.

(9) After considering the benefit-cost aspects of the project, balance the benefits of the proposed project (tabulation of ESRP 10.4.1) against the total environmental costs (tabulation of ESRP 10.4.2) and reach a final conclusion as to the overall benefit-cost balance of the project.

IV. EVALUATION FINDINGS

This section of the environmental statement should contain a summary of the principal benefits and principal costs and, as appropriate, a discussion of the basis of important modifications and alternatives that may be identified. The section should contain relevant summaries of the basis for accepting the proposed site, need for power, major design features, and principal environmental impacts. A summary table comparing benefits and costs, similar to Table 10.4.3-1, may be provided.

If the staff's benefit-cost balance of the proposed project is favorable, this section should contain a relevant summary paragraph such as the following:

For construction permits, operating licenses, and combined licenses:

> "The staff concludes, on the basis of the assessments summarized in this environmental statement, that the construction and operation of the _____ _____, with modifications as identified by the staff, are needed by the service area in the time frame projected, and will have accrued benefits that outweigh the economic, environmental, and social costs. Further, the overall benefit-cost balance would not be significantly improved by selection of an alternative site or by use of an alternative generating system."

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.71, "Draft environmental impact statement—contents."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52.18, "Standards for review of applications."

10 CFR 52.81, "Standards for review of applications."

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

Table 10.4.3-1. Benefit-Cost Balance for the Project

Benefit-Cost Category	Project as Proposed	With Option 1	With Option 2	...	Alternative 1	...
Project Description	As Proposed	[Short Description]	[Short Description]			
BENEFITS						
Electricity Generated						
Generating Capacity						
Other Monetary (specify and compute) Non-Monetary (specify and characterize)						
COSTS						
Direct Production Costs						
Indirect Production Costs						
Measures and Controls to Reduce Environmental Impacts						
Environmental Costs (specify)						
Effect 1 Impact (quantified, if possible)						
Significance in Region						
Effect 2						
Effect 3						
Other						

Appendix A

Guide to Relevant Environmental Standard Review Plans

Appendix A

Guide to Relevant Environmental Standard Review Plans

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Introduction

The licensing framework established by the Nuclear Regulatory Commission (NRC) covers a wide range of actions that require various levels of environmental review. The original Environmental Standard Review Plans (ESRPs) (NUREG-0555) (NRC 1978) were written explicitly to guide environmental reviews and preparation of environmental impact statements (EISs) associated with applications for nuclear power plant construction permits (CPs) (10 CFR 50) and EIS supplements in connection with the issuance of an operating license (OL) (10 CFR 50). In the years since the preparation of the original ESRPs, the addition of 10 CFRs 52 and 54 has expanded the licensing framework. The framework now includes early site permits (ESPs) (10 CFR 52, Subpart A); combined licenses (COLs) that reference an ESP (10 CFR 52, Subpart C); COLs that do not reference an ESP (10 CFR 52, Subpart C); and license renewal (LR) (10 CFR 54).

Each of these licensing actions requires a specific set of environmental reviews that ultimately lead to an EIS or supplement to an EIS. The table presented in this appendix is a guide to selection of ESRPs that are appropriate for use in reviews associated with each of these licensing actions except LR. LR is treated in a supplement to this document. ESRPs are listed in rows by numerical order, and columns designate the application type. The entries in the cells indicate whether the review in connection with the application should include the topic covered by the ESRP assuming that the application is associated with a "green field" location. A "green field" location is defined as an undeveloped site. The cell entries are derived from requirements presented in 10 CFRs 50, 51, 52, and 54 and other regulatory guidance as of June 1, 1997. NRC Environmental Project Managers (EPMs) for reviews leading to preparation of EISs and supplements should review current Commission policy for changes to specific license requirements at the start of each project.

Commission regulations also provide for environmental reviews of limited scope. Limited Work Authorizations are permitted by 10 CFR 50.10(e) and 10 CFR 52.25(a); 10 CFR 2, Subpart F, provides for Early Partial Decisions on Site Suitability Issues in connection with an application for construction; and 10 CFR 52, Appendix Q, provides for Pre-Application Early Review of Site Suitability Issues. It is anticipated that the guidance for the review and application handling process related to these matters will be covered in the *Project Manager's Handbook* (NRC 1989). EPMs will direct reviewers to individual ESRPs in this document that may be useful in dealing with a specific matter under consideration.

According to 10 CFR 51, Subpart A, Appendix A.1(b) and 10 CFR 51.95(a), the techniques of tiering and incorporation by reference may be used as appropriate to aid in the presentation of issues, eliminate repetition, or reduce the size of an EIS; in so doing, the EIS will summarize the discussion in the referenced document and provide specific section references to ensure that the public has easy access to relevant information. In appropriate circumstances, draft or final EISs of other Federal agencies may be adopted in whole or in part consistent with the procedures outlined in 40 CFR 1506.3. The concept of tiering is especially applicable to the preparation of EISs associated with COL applications that reference ESPs, and for EIS supplements in connection with OLs and LR. However, tiering should be considered

whenever there are existing environmental documents that contain relevant information. For example, tiering should be considered in the case of an application for a CP, ESP, or COL for a new plant at an existing nuclear facility.

References

10 CFR 2, Subpart F, "Additional Procedures Applicable to Early Practical Decisions on Site Suitability Issues in Connection With an Application for a Permit to Construct Certain Utilization in Facilities."

10 CFR 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR 50.10, "License required."

10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR 51, Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)."

10 CFR 51, Appendix A, "Format for Presentation of Material in Environmental Impact Statements."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

10 CFR 52, Subpart A, "Early Site Permits."

10 CFR 52, Subpart C, "Combined Licenses."

10 CFR 52, Appendix Q, "Pre-application Early Review of Site Suitability Issues."

10 CFR 52.25, "Early site permits; extent of activities permitted."

10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR 1506.3, Other Requirements of NEPA: "Adoption."

U.S. Nuclear Regulatory Commission (NRC). 1978. *Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants.* NUREG-0555, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1989. *Project Manager's Handbook*, NUREG/BR-0073, Rev. 1, Washington, D.C.

Environmental Standard Review Plan Cross-Reference Table

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
1.0	Introduction to the EIS	Include	Include for CP and OL	Include	Include
1.1	The Proposed Project	Include	Include for CP and update for OL	Include	Include
1.2	Status of Reviews and Approvals	Include	Include for CP and update for OL	Include	Include
2.0	Environmental Description	Include	Include for CP and OL	Include	Include summary
2.1	Station Location	Include	Include for CP and OL	Include	Include summary
2.2	Land	Include	Include for CP and OL	Include	Include
2.2.1	The Site and Vicinity	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.2.2	Transmission Corridors and Offsite Areas	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.2.3	The Region	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.3	Water	Include	Include for CP and OL	Include	Include
2.3.1	Hydrology	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.3.2	Water Use	Include	Include for CP and update for OL	Include	Reference ESP and update information

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
2.3.3	Water Quality	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.4	Ecology	Include	Include for CP and OL	Include	Include
2.4.1	Terrestrial Ecology	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.4.2	Aquatic Ecology	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.5	Socioeconomics	Include	Include for CP and OL	Include	Include
2.5.1	Demography	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.5.2	Community Characteristics	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.5.3	Historic Properties	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.5.4	Environmental Justice	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.6	Geology	Include	Include for CP	Include	Reference ESP
2.7	Meteorology and Air Quality	Include	Include for CP and update for OL	Include	Reference ESP and update information
2.8	Related Federal Project Activities	Include	Include for CP and update for OL	Include	Reference ESP and update information

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
3.0	Plant Description	Include	Include for CP and OL	Include	Include
3.1	External Appearance and Plant Layout	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.2	Reactor-Power Conversion System	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.3	Plant Water Use	Include	Include for CP and OL	Include	Include
3.3.1	Water Consumption	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.3.2	Water Treatment	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.4	Cooling System	Include	Include for CP and OL	Include	Include

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
3.4.1	Description and Operational Modes	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.4.2	Component Descriptions	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.5	Radioactive Waste Management System	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.6	Nonradioactive Waste Systems	Include	Include for CP and OL	Include	Include
3.6.1	Effluents Containing Chemicals or Biocides	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.6.2	Sanitary System Effluents	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
3.6.3	Other Effluents	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.7	Power Transmission Systems	Include	Include for CP and update for OL	Include	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
3.8	Transportation of Radioactive Materials	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Include in sufficient detail to determine that plant design falls within parameters specified in Early Site Permit
4.0	Environmental Impacts of Construction	Include	Include for CP	Include	Include
4.1	Land-Use Impacts	Include	Include for CP	Include	Include
4.1.1	The Site and Vicinity	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.1.2	Transmission Corridors and Offsite Areas	Include	Include for CP	Include	Precluded unless criteria for reconsideration are met. Otherwise include.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
4.1.3	Historic Properties	Include	Include for CP	Include	Precluded unless criteria for reconsideration are met. Otherwise include.
4.2	Water-Related Impacts	Include	Include for CP	Include	Include
4.2.1	Hydrologic Alterations	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.2.2	Water-Use Impacts	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.3	Ecological Impacts	Include	Include for CP	Include	Include
4.3.1	Terrestrial Ecosystems	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.3.2	Aquatic Ecosystems	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.4	Socioeconomic Impacts	Include	Include for CP	Include	Include

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
4.4.1	Physical Impacts	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.4.2	Social and Economic Impacts	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.4.3	Environmental Justice Impacts	Include	Include for CP	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.5	Radiation Exposure to Construction Workers	Include	Include for CP	Include—based on reactor or reactors with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
4.6	Measures and Controls to Limit Adverse Impacts During Construction	Include	Include for CP	Include—based on reactor or reactors with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.0	Environmental Impacts of Station Operation	Include	Include for CP and OL	Include	Include
5.1	Land-Use Impacts	Include	Include for CP and OL	Include	Include

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
5.1.1	The Site and Vicinity	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.1.2	Transmission Corridors and Offsite Areas	Include	Include for CP and update for OL	Include	Precluded unless criteria for reconsideration are met. Otherwise include.
5.1.3	Historic Properties	Include	Include for CP and update for OL	Include	Precluded unless criteria for reconsideration are met. Otherwise include.
5.2	Water-Related Impacts	Include	Include for CP and OL	Include	Include
5.2.1	Hydrological Alterations and Plant Water Supply	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.2.2	Water-Use Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3	Cooling System Impacts	Include	Include for CP and OL	Include	Include
5.3.1	Intake System	Include	Include for CP and OL	Include	Include

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
5.3.1.1	Hydrodynamic Descriptions and Physical Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3.1.2	Aquatic Ecosystems	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3.2	Discharge System	Include	Include for CP and OL	Include	Include
5.3.2.1	Thermal Description and Physical Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3.2.2	Aquatic Ecosystems	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3.3	Heat Discharge System	Include	Include for CP and OL	Include	Include

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
5.3.3.1	Heat Dissipation to the Atmosphere	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3.3.2	Terrestrial Ecosystems	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.3.4	Impacts to Man	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.4	Radiological Impacts of Normal Operation	Include	Include for CP and OL	Include	Include
5.4.1	Exposure Pathways	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
5.4.2	Radiation Doses to Members of the Public	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.4.3	Impacts to Man	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.4.4	Impacts to Biota Other Than Man	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.5	Environmental Impacts of Waste	Include	Include for CP and OL	Include	Include
5.5.1	Nonradioactive Waste System Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.5.2	Mixed Waste Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
5.6	Transmission System Impacts	Include	Include for CP and OL	Include	Include
5.6.1	Terrestrial Ecosystems	Include	Include for CP and update for OL	Include	Precluded unless criteria for reconsideration are met. Otherwise include.
5.6.2	Aquatic Ecosystems	Include	Include for CP and update for OL	Include	Precluded unless criteria for reconsideration are met. Otherwise include.
5.6.3	Impacts to Man	Include	Include for CP and update for OL	Include	Precluded unless criteria for reconsideration are met. Otherwise include.
5.7	Uranium Fuel Cycle Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.8	Socioeconomic Impacts	Include	Include for CP and OL	Include	Include
5.8.1	Physical Impacts of Station Operation	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.8.2	Social and Economic Impacts of Station Operation	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
5.8.3	Environmental Justice Impacts	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.9	Decommissioning	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
5.10	Measures and Controls to Limit Adverse Impacts During Operation	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Otherwise include.
6.0	Environmental Measurements and Monitoring Programs	Include	Include for CP and OL	Include	Include
6.1	Thermal Monitoring	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information
6.2	Radiological Monitoring	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Reference ESP EIS and update information

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
6.3	Hydrological Monitoring	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information
6.4	Meteorological Monitoring	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information
6.5	Ecological Monitoring	Include	Include for CP and OL	Include	Include
6.5.1	Terrestrial Ecology and Land Use	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information
6.5.2	Aquatic Ecology	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information
6.6	Chemical Monitoring	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
6.7	Summary of Monitoring Programs	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Reference ESP EIS and update information
7.0	Environmental Impacts of Postulated Accidents Involving Radioactive Materials	Include	Include for CP and update for OL	Include	Include
7.1	Design Basis Accidents	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Reference ESP EIS and update information
7.2	Severe Accidents	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Reference ESP EIS and update information
7.3	Severe Accident Mitigation Design Alternatives	Include—For COL referencing design certification with SAMA analysis, include analysis thereof.	Include for CP	Include	Include—For COL referencing design certification with SAMA analysis, include analysis thereof
7.4	Transportation Accidents	Include	Include for CP and update for OL	Include—based on reactor or reactors with postulated characteristics	Reference ESP EIS and update information

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
8.0	Need for Power	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
8.1	Description of Power System	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
8.2	Power Demand	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
8.2.1	Power and Energy Requirements	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
8.2.2	Factors Affecting Growth of Demand	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
8.3	Power Supply	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
8.4	Assessment of Need for Power	Include	Include for CP only, unless otherwise required by the Commission	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
9.0	Alternatives to the Proposed Action	Include	Include for CP and OL	Include	Include
9.1	No-Action Alternative	Include	Include for CP and OL	Include	Include
9.2	Energy Alternatives	Include	Include for CP only, unless otherwise required by the Commission	Include	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
9.2.1	Alternatives Not Requiring New Generating Capacity	Include	Include for CP only, unless otherwise required by the Commission	Include	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
9.2.2	Alternatives Requiring New Generating Capacity	Include	Include for CP only, unless otherwise required by the Commission	Include	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
9.2.3	Assessment of Alternative Energy Sources and Systems	Include	Include for CP only, unless otherwise required by the Commission	Include	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
9.3	Alternative Sites	Include	Include for CP only, unless otherwise required by the Commission	Include	Precluded unless criteria for reconsideration are met. Include if criteria are met.
9.4	Alternative Plant and Transmission Systems	Include	Include for CP and update for OL	Include	Include
9.4.1	Heat Dissipation Systems	Include	Include for CP and update for OL	Include	Reference ESP EIS and update information
9.4.2	Circulating Water Systems	Include	Include for CP and update for OL	Include	Reference ESP EIS and update information
9.4.3	Transmission Systems	Include	Include for CP and update for OL	Include	Reference ESP EIS and update information
10.0	Environmental Consequences of the Proposed Action	Include	Include for CP and OL	Include	Include
10.1	Unavoidable Adverse Environmental Impacts	Include	Include for CP and update for OL	Include	Precluded unless criteria for reconsideration are met. Include if criteria are met.
10.2	Irreversible and Irretrievable Commitments of Resources	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Include if criteria are met.

Environmental Standard Review Plan Cross-Reference Table (contd)

Plan	Title	Combined License Without Early Site Permit	Construction Permit/ Operating License	Early Site Permit	Combined License with Early Site Permit
10.3	Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment	Include	Include for CP and update for OL	Include—based on reactor or reactors and cooling systems with postulated characteristics	Precluded unless criteria for reconsideration are met. Include if criteria are met.
10.4	Benefit-Cost Balance	Include	Include for CP and OL	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
10.4.1	Benefits	Include	Include for CP and update for OL	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
10.4.2	Costs	Include	Include for CP and update for OL	Need not be included unless applicant seeks approval	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.
10.4.3	Summary	Include	Include for CP and OL	Include	Precluded if considered with ESP and criteria for reconsideration are not met. Otherwise include.

Appendix B

Environmental Standard Review Plan
Review Responsibilities

Appendix B

Environmental Standard Review Plan
Review Responsibilities

This appendix lists the organization within the U.S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation having review responsibility for each Environmental Standard Review Plan. The review responsibility list is current as of October 1999.

Plan	Primary Responsibility	Secondary Responsibility
1.0	Generic Issues, Environmental, Financial and Rulemaking Branch (RGEB)	None
1.1	RGEB	None
1.2	RGEB	None
2.0	RGEB	None
2.1	RGEB	None
2.2	RGEB	None
2.2.1	RGEB	None
2.2.2	RGEB	None
2.2.3	RGEB	None
2.3	RGEB	None
2.3.1	RGEB	None
2.3.2	RGEB	None
2.3.3	RGEB	None
2.4	RGEB	None
2.4.1	RGEB	None
2.4.2	RGEB	None
2.5	RGEB	None
2.5.1	RGEB	None
2.5.2	RGEB	None
2.5.3	RGEB	None
2.5.4	RGEB	None
2.6	RGEB	None
2.7	RGEB	None

Plan	Primary Responsibility	Secondary Responsibility
2.8	RGEB	None
3.0	RGEB	None
3.1	RGEB	None
3.2	RGEB	None
3.3	RGEB	None
3.3.1	RGEB	None
3.3.2	RGEB	None
3.4	RGEB	None
3.4.1	RGEB	None
3.4.2	RGEB	None
3.5	RGEB	None
3.6	RGEB	None
3.6.1	RGEB	None
3.6.2	RGEB	None
3.6.3	RGEB	None
3.7	RGEB	None
3.8	RGEB	None
4.0	RGEB	None
4.1	RGEB	None
4.1.1	RGEB	None
4.1.2	RGEB	None
4.1.3	RGEB	None
4.2	RGEB	None
4.2.1	RGEB	None
4.2.2	RGEB	None
4.3	RGEB	None
4.3.1	RGEB	None
4.3.2	RGEB	None
4.4	RGEB	None
4.4.1	RGEB	None
4.4.2	RGEB	None
4.4.3	RGEB	None
4.5	Operator Licensing, Human Performance and Plant Support Branch (IOLB)	RGEB
4.6	RGEB	None

Plan	Primary Responsibility	Secondary Responsibility
5.0	RGEB	None
5.1	RGEB	None
5.1.1	RGEB	None
5.1.2	RGEB	None
5.1.3	RGEB	None
5.2	RGEB	None
5.2.1	RGEB	None
5.2.2	RGEB	None
5.3	RGEB	None
5.3.1	RGEB	None
5.3.1.1	RGEB	None
5.3.1.2	RGEB	None
5.3.2	RGEB	None
5.3.2.1	RGEB	None
5.3.2.2	RGEB	None
5.3.3	RGEB	None
5.3.3.1	RGEB	None
5.3.3.2	RGEB	None
5.3.4	RGEB	None
5.4	RGEB	None
5.4.1	RGEB	None
5.4.2	IOLB	RGEB
5.4.3	IOLB	RGEB
5.4.4	RGEB	None
5.5	RGEB	None
5.5.1	RGEB	None
5.5.2	RGEB	None
5.6	RGEB	None
5.6.1	RGEB	None
5.6.2	RGEB	None
5.6.3	RGEB	None
5.7	RGEB	None
5.8	RGEB	None
5.8.1	RGEB	None
5.8.2	RGEB	None

Plan	Primary Responsibility	Secondary Responsibility
5.8.3	RGEB	None
5.9	RGEB	None
5.10	RGEB	None
6.0	RGEB	None
6.1	RGEB	None
6.2	IOLB	RGEB
6.3	RGEB	None
6.4	RGEB	None
6.5	RGEB	None
6.5.1	RGEB	None
6.5.2	RGEB	None
6.6	RGEB	None
6.7	RGEB	None
7.0	RGEB	None
7.1	Probabilistic Safety Assessment Branch (SPSB)	RGEB
7.2	SPSB	RGEB
7.3	SPSB	RGEB
7.4	RGEB	None
8.0	RGEB	None
8.1	RGEB	None
8.2	RGEB	None
8.2.1	RGEB	None
8.2.2	RGEB	None
8.3	RGEB	None
8.4	RGEB	None
9.0	RGEB	None
9.1	RGEB	None
9.2	RGEB	None
9.2.1	RGEB	None
9.2.2	RGEB	None
9.2.3	RGEB	None
9.3	RGEB	None
9.4	RGEB	None
9.4.1	RGEB	None
9.4.2	RGEB	None

Plan	Primary Responsibility	Secondary Responsibility
9.4.3	RGEB	None
10.0	RGEB	None
10.1	RGEB	None
10.2	RGEB	None
10.3	RGEB	None
10.4	RGEB	None
10.4.1	RGEB	None
10.4.2	RGEB	None
10.4.3	RGEB	None

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SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This document provides guidance to the staff in implementing provisions of 10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," related to new site/plant applications. It supercedes "Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants," NUREG-0555, issued in 1978. New technical issues- such as environmental justice and severe-accident mitigation design alternatives, and new licensing structures, such as early site permits, combined licenses, and license renewal - have raised the need for new regulatory guidance.

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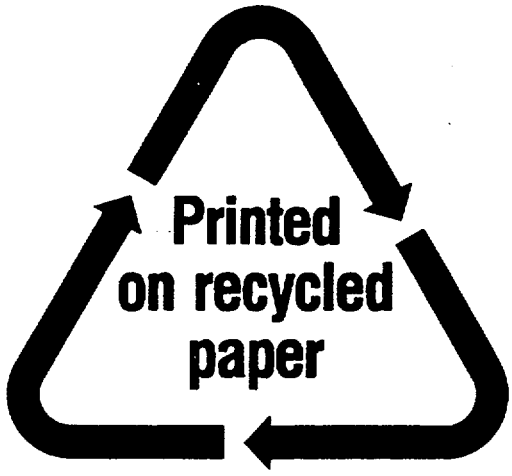

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