U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

STANDARD REVIEW PLANS FOR ENVIRONMENTAL REVIEWS FOR NUCLEAR POWER PLANTS

October 1999

OFFICE OF NUCLEAR REACTOR REGULATION
U.S. NUCLEAR REGULATORY COMMISSION

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USNRC ENVIRONMENTAL STANDARD REVIEW PLAN

Environmental standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for environmental reviews for nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Environmental standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The environmental standard review plans are keyed to Preparation of Environmental Reports for Nuclear Power Stations.

Published environmental standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555-0001.

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ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.3 WATER

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 portions of the environmental impact statement (EIS) that address hydrological and water-quality issues. The scope of the paragraph covered by this plan introduces the material to be presented from the reviews conducted under ESRPs 2.3.1, 2.3.2, and 2.3.3.

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 introductory paragraph prepared under this ESRP should be 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 hydrological and water quality program 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 2.3.1, 2.3.2, and 2.3.3. This paragraph should list the types of information to be presented and describe the relationships of this information 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

2.3.1 HYDROLOGY

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 surface-water bodies and groundwater aquifers that could affect the plant-water supply and effluent disposal or that could be affected by plant construction or operation of the proposed project, including transmission corridors and offsite facilities. The scope of the review directed by this plan includes consideration of site-specific and regional data on the physical and hydrological characteristics of ground and surface water in sufficient detail to provide the basic data for other reviews addressing the evaluation impacts on water bodies, aquifers, aquatic ecosystems, and social and economic structures of the 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 2.3.2. Obtain descriptions of the region's water uses (e.g., the location and nature of water users and water-use areas) for the area surrounding the proposed plant site (for the purpose of determining the level of detail required for the description of the hydrology).

- ESRPs 2.3.2, 2.3.3, 2.4.2, 3.4.2, 4.1.1 through 4.1.3, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.2.1, 5.2.2, 5.3.1.1, 5.3.1.2, 5.3.2.1, 5.3.2.2, 5.4.1, 5.5.1, 5.5.2, 6.1, 6.3, 6.6, and 9.4.1. Provide descriptive information in ESRP 2.3.1 in sufficient detail to support the descriptions and assessments given in these ESRPs.

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 and distance from the site. General, surface-water, and groundwater data and information should be obtained as described in the following sections. The following general[(a)] data or information should be obtained:

- maps (including digital databases such as a Geographic Information System [GIS]) of sufficient detail to show the relationship of the site to major hydrological systems that could affect or be affected by plant construction or operation (from the environmental report [ER] and the general literature)

- for surface-water bodies used as a heat sink, maximum, average-maximum, average, average-minimum, and minimum monthly temperature of the water body (from the ER and the general literature)

- for surface-water bodies and wetlands, estimated erosion characteristics and sediment transport, including rate, bed, and suspended load fractions, and graduation analyses; a description of the floodplain[(b)] and its relationship to the site; a description of wetlands and their relationship to the site; the design-basis flood (DBF) elevation; and, where applicable, the DBF discharge (from the ER and the general literature).

Surface-water data and information to be obtained fall under three categories: freshwater streams, lakes and impoundments, and estuaries and oceans.

The following data and information about freshwater streams (for the watershed containing the site) should be obtained:

- a list of major streams, size of drainage areas, and gradient (from the ER and consultation with Federal, State, regional, local, and Native American tribal agencies)

(a) Features necessary to describe the hydrosphere but that do not provide a basis for assessing impacts need not be described in great detail.

(b) "Floodplain" is defined as the lowland and relatively flat areas adjoining inland and coastal waters, including floodplain areas of offshore islands. This includes, at a minimum, that area subject to a 1% or greater chance of flooding in any given year. The base floodplain shall be used to designate the 100-year floodplain (1% chance floodplain). The critical action floodplain is defined as the 500-year floodplain (0.2% chance floodplain) (from Executive Order 11988, "Floodplain Management").

- maximum, average maximum, average, average minimum, and minimum monthly flow (from the ER and the general literature)

- flood frequency distributions (from the ER and the general literature), including levee failures (from the ER and the general literature)

- flood control measures (reservoirs, levees, flood forecasting) (from the ER, the general literature, and the site visit)

- historical drought stages and discharges by month, and the 7-day once-in-10-years low flow (from the ER and the general literature)

- important short-duration flow fluctuations (e.g., diurnal release variations from peaking operation of upstream hydroelectric project) (from the ER and consultation with local agencies)

- within the influence of the intake and discharge structures, velocity distribution (horizontal and vertical), bathymetry at and near the intake structure, bathymetry at and downstream of the discharge structure, and stream cross-sections (from the ER)

- other hydrographic modifications (e.g., diversion dams, channelization) (from the ER and site visit)

- a list of wetlands and floodplains and their seasonal characteristics.

The following data and information about lakes and impoundments should be obtained:

- a description of lake or impoundment (from the ER and site visit)

- where influenced by the intake or discharge structures, or vice versa, size, location, and elevation of outlets (from the ER and the general literature)

- where influenced by the intake or discharge structures, or vice versa, elevation-area-capacity curves (from the ER and the general literature)

- a summary description of reservoir operating rules (from the ER and consultation with local agencies)

- annual yield and dependability (from the ER and consultation with local agencies)

- variations in inflows, outflows, water surface elevations, and storage volumes and retention time (from the ER and the general literature)

- net loss, including evaporation and seepage (from the ER and the general literature)

- current patterns, including frequency distributions of current speed, direction, and persistence (from the ER and the general literature)

- temperature distribution (horizontal and vertical) and stratification and seasonal variations of density-induced currents (from the ER)

- detailed bathymetry in vicinity of station intake and outfall (from the ER).

The following data and information about estuaries and oceans should be obtained:

- shoreline and bottom descriptions, including seasonal variations due to sediment transport (from the ER and site visit)

- tidal current patterns (velocities and phases), range, and excursion (from the ER and the general literature)

- nontidal circulation patterns, including frequency distributions of current speed, direction, and persistence (from the ER and the general literature)

- temperature and salinity distribution (horizontal and vertical), including temporal variations (from the ER and the general literature)

- detailed bathymetry in the vicinity of the station intake and outfall (from the ER)

- for estuaries, maximum, average maximum, average, average minimum, and minimum monthly river discharge and flushing characteristics (from the ER and the general literature).

The following groundwater data and information should be obtained:

- the areal extent of aquifers, recharge and discharge areas, elevation and depth, and geologic formations (from the ER and the general literature)

- piezometric contour maps and hydraulic gradients (historical, if available, and current) (from the ER and the general literature)

- flow travel times (from the ER and the general literature)

- soil properties, including permeabilities or transmissivities, storage coefficients or specific yields, total and effective porosities, clay content, and bulk densities (from the ER and the general literature)

- interactions between site surface and groundwaters (from the ER and the general literature)

- historical and seasonal trends in groundwater elevation or piezometric levels; interactions between different aquifers (from the ER and the general literature)

- recharge rates, soil moisture characteristics, and moisture content in vadose zone

- existence of any local aquifers designated or proposed to be designated as "sole source aquifers."

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the hydrology at the proposed plant site 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 the National Pollutant Discharge Elimination System (NPDES) permit conditions for discharges, including stormwater discharges

- 40 CFR 124 with respect to the NPDES process

- 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

- State 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 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 United States 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 description of the area's hydrology is discussed in the following paragraph:

A detailed and thorough description of the hydrologic environment is essential for the evaluation of potential impacts to the environment that may result from plant construction or operation. This ESRP provides the key background material that is essential for understanding the impacts on water use, water quality, land use, ecological systems, and monitoring programs.

III. REVIEW PROCEDURES

The reviewer's analysis of hydrology will be closely linked with the environmental reviews described by ESRP Chapters 3.0, 4.0, 5.0, and 6.0 to establish the hydrological characteristics that are most likely to be affected and the adequacy of the related monitoring programs. The reviewer should take the following steps:

(1) Identify the monthly and annual ranges and averages, and the historical extremes of the physical and hydrological characteristics of the hydrosphere potentially affecting or affected by plant construction and operation.

(2) Adjust the historical data to present or known future conditions (e.g., reservoirs built and operated during the period of record, scheduled construction of dams).

(3) Develop data or take measurements using acceptable hydrological techniques if observations are incomplete or unavailable.

(4) Determine if the site or any plant-related structure or alteration of the natural topography is on a floodplain or wetland.

(5) Use river-basin commissions, State agencies, and Federal agencies, such as the Corps of Engineers and the U.S. Geological Survey (USGS), as possible sources for site-specific data, including the following:

- comprehensive framework studies of water and related lands by river basin planning organizations and regional interagency committees
- reports and data from Federal agencies, including the USGS, Bureau of Reclamation, Natural Resources Conservation Service, Forest Service, Agricultural Research Service, Weather Service, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration (NOAA), Coast Guard, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the Federal Highway Administration
- reports and data by regional power administrations such as the Bonneville Power Administration and Tennessee Valley Authority
- STOrage and RETrieval System for Water and Biological Data (STORET) water-quality data for specified geographic area, time period, and water-quality constituents from the EPA
- State 303(d) list
- well logs from water well drillers
- reports and data from State agencies, including ecology, conservation, public health, fish and game, forestry, agriculture, water resources, State lands, State engineer, and highway departments and special natural resources commissions (names and functions vary from State to State), and from Native American tribes
- standard handbooks (Maidment 1992; Linsley, Kohler, and Paulhus 1982; Mays 1996).

The depth and extent of the input to the environmental impact statement (EIS) will be governed by the hydrological resources that could affect or be affected by plant construction or operation and by the nature and magnitude of the expected impacts. With this in mind, the reviewer should take the following steps:

(1) Ensure that

- data are sufficient to provide quantitative information on the hydrological resources potentially affecting or affected by plant construction and operation
- Federal, State, regional, local, and affected Native American tribal agencies appropriate to the objectives of this environmental review have been consulted

- sufficient data are provided for the assessment of anticipated impacts during the period of plant operation.

(2) Where necessary, evaluate the collection of additional data and the substantiation of methodology used to estimate hydrological parameters.

(3) Assess the hydrological descriptions with respect to relevancy, completeness, reliability, and accuracy of input to the impact assessments of other sections.

(4) Verify that the measurements and data development programs use accepted hydrological practice (which includes those identified in the references listed in this ESRP).

IV. EVALUATION FINDINGS

The reviewer should verify that sufficient information has been provided to support the analyses required in subsequent reviews.

The depth and extent of the input to the EIS will be governed by the nature of the surface-water bodies and groundwater aquifers in the region and the extent to which they could affect or be affected by plant construction or operation. The following information should be included in the EIS:

- a description of the sources of water to be used by the plant
- a description of the potential impacts of the water bodies on the plant
- a description of the potential impacts of the plant on water bodies.

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 124, “Procedures for Decisionmaking.”

40 CFR 149, “Sole Source Aquifers.”

40 CFR 227, “Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials.”

Executive Order No. 11988, “Floodplain Management,” 42 *Federal Register* 46499 (1977) (see U.S. Water Resources Council for guidelines for implementing EO 11988).

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 152 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).

Linsley, R. K., M. A. Kohler, and J. L. H. Paulhus. 1982. *Hydrology for Engineers*, Third Edition, McGraw-Hill Book Company, New York.

Maidment, D., ed. 1992. *Handbook of Hydrology*, McGraw Hill Book Company, New York.

Mays, L. W., ed. 1996. *Water Resources Handbook*. McGraw-Hill Book Company, New York.

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. Water Resources Council, Floodplain Management Guidelines for Implementing E.O. 11988, 43 *Federal Register* 6030 (1978).

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.3.2 WATER USE

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of surface-water and groundwater uses that could affect or be affected by the construction or operation of the proposed project, including transmission corridors and offsite facilities. The scope of the review directed by this plan includes (1) consideration of such water uses as domestic, municipal, agricultural, industrial, mining, recreation, navigation, and hydroelectric power, (2) identification of their locations, and (3) quantification of water diversions, consumption, and returns. The review should be limited to present and known future water uses.

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. Obtain descriptions of the regional land uses for the area surrounding the proposed plant site.

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

- ESRP 2.3.1. Provide 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 (for the purpose of

assisting that reviewer in determining the level of detail required for the description of the hydrology).

- ESRPs 2.3.3, 3.3, 3.3.1, 3.3.2, 4.2, 4.2.1, 4.2.2, 4.3, 4.3.1, 4.3.2, 4.4, 5.2, 5.2.1, 5.2.2, 5.3, 5.3.2.1, 5.3.2.2, 5.4, 5.4.1, 5.5, 5.5.1, 5.5.2, 5.8, 5.8.1, 6.2, 6.3, 6.6, and 9.4.2. Provide descriptive information in ESRP 2.3.2 in sufficient detail to support the descriptions and assessments given in these ESRPs.

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 on existing and known future water uses during the period of project operation. The following data or information should be obtained:

- maps (including digital databases such as a Geographic Information System [GIS]) showing the relationship of the site to the major hydrological systems (from the environmental report [ER] and the general literature)

- maps showing the relationship of the site to surface-water bodies that could affect or be affected by plant water use (from the ER and the general literature)

- maps (and cross sections where feasible) showing those portions of groundwater aquifer systems that could be affected by plant withdrawals and/or discharges (from the ER and the general literature)

- quantitative description of present and known future groundwater withdrawals on the site and for distances great enough to cover aquifers that may affect or be adversely affected by the plant. The following should be included for each withdrawal or discharge:

  - location and depth of well with respect to the site (from the ER, the site visit, peer-reviewed technical literature, and consultation with State and local agencies)

  - identification of aquifers (from the ER, peer-reviewed technical literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

  - the average monthly withdrawal rates by use category (from the ER, the site visit, peer-reviewed technical literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

  - identification of any aquifers designated by EPA as sole source aquifers.

- quantitative description of present and known future surface-water uses (withdrawals, consumptions, and returns) that are within the hydrological system in which the site is located and that may affect or

be affected by the plant. This should include a quantitative description of any water uses that provide potential liquid pathways for both radiological and nonradiological effluents. The following should be included for each withdrawal or discharge:

- locations of diversions and returns with respect to the site and the water body (from the site visit, the general literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- identification of the water body (from the ER and the general literature)

- the average monthly withdrawal and return rate for each diversion by use category.

- quantitative and qualitative description of recreational, navigational, instream, and other nonconsumptive present and known future water uses. For a 10-km (6-mi) radius, this should include the following (from the ER, site visit, peer-reviewed technical literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies):

  - identification of water bodies and locations with respect to the site (maps may be useful)

  - the kind and location of activity on the water body (maps may be useful)

  - the use rate with time variation.

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

- a water-use diagram for the plant (Rosaler 1994) showing flow rates to and from the various water systems (e.g., circulating water system, sanitary system, radwaste and chemical waste systems, service water systems), points of consumption, and source and discharge locations (from the ER)

- for the water-use diagram, the data and narrative description for maximum water consumption, water consumption during periods of minimum water availability, and average operation by month and by plant operating status (from the ER)

- a description of other station water uses (i.e., all facilities not associated with the proposed plant) showing flow rates to and from the facility, average water consumption, and maximum water consumption (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of water use 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 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

- 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) should 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 United States 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 description of surface-water and groundwater uses that could affect or be affected by construction or operation is discussed in the following paragraph:

A detailed and thorough description of the regional and plant water use is essential for the evaluation of potential impacts on the environment that may result from plant construction or operation. This

ESRP reviews the key water-use background material that is essential for understanding the impacts on water use, water quality, land use, ecological systems, and monitoring programs during both construction and operation.

III. REVIEW PROCEDURES

The reviewer's analysis of surface-water and groundwater use should consider the aspects of water use that are concerned with consumptive use, nonconsumptive use, and effluent pathways. The depth of analysis will be related to the importance of water use and proximity of the use to the plant. With this in mind, the reviewer should take the following steps:

(1) Identify consumptive water uses that could affect the water supply of the plant or that may be adversely affected by the plant, including the following important characteristics:

- water source
- locations of diversions and returns
- amount and time variation of use
- water rights.

(2) Identify recreational, navigational, and other nonconsumptive water uses, including those that could be affected by transmission line and offsite area construction and operation. The important characteristics to be quantified are

- location
- activity
- amount and time variation of use.

(3) Identify the water uses that provide potential pathways for both radiological and nonradiological effluents, including the following important characteristics:

- water sources
- location of diversions for consumptive uses
- location of receptors for nonconsumptive uses
- amount and time variation of use for each.

(4) In addition to information obtained from the applicant's ER and from responses to subsequent questions to the applicant, use additional sources of data, such as

- local water supply companies or agencies
- river basin commissions
- State agencies (e.g., water resources, fish and wildlife)

- various Federal agencies, such as the Corps of Engineers and the U.S. Geological Survey, and Native American tribal agencies when needed to complete the analysis. Local water users may be questioned during the site visit.

(5) Using the above information, compile and tabulate water uses by the categories and characteristics described in this ESRP section, but limit the analysis to consideration of present and known future water uses.

(6) Ensure that water-use data and information are adequate to serve as a basis for assessing the impacts of proposed project construction and operation on consumptive and nonconsumptive water uses.

(a) In evaluating the adequacy of this material, the reviewer should ensure that data are

- sufficient to provide quantitative information on water-use characteristics to be impacted by construction and operation

- are adequate to predict water-use impacts to the plant during construction and operation.

(b) Consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies in making this evaluation.

IV. EVALUATION FINDINGS

The depth and extent of the input to the environmental impact statement (EIS) will be governed by the water uses that could be affected by the proposed project construction or operation (or that may affect the plant) and by the nature and magnitude of the expected impacts to water use. The following information should be included in the EIS:

- a summary of present and known future groundwater withdrawals on the site and for distances great enough to cover potentially affected groundwater aquifers. Appropriate maps or descriptions from ESRP 2.3.1 will be referenced to depict the groundwater hydrology. References to applicable State and Native American tribal water-use laws should also be included.

- a summary of present and known future surface-water uses that are within the hydrological system in which the plant is located and that may affect or be adversely affected by the plant. Appropriate maps or descriptions from ESRP 2.3.1 will be referenced to depict the surface-water hydrological system being used. References to applicable State and Native American tribal water-use laws should also be included.

- a summary of present and known future recreational, navigational, and other nonconsumptive water uses (maps may be useful).

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 of Floodplain Management and Wetlands Protection."

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

40 CFR 149, "Sole Source Aquifers."

Federal Water Pollution Control Act (FWCPA), 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).

Rosaler, R. (ed.). 1994. *Standard Handbook of Plant Engineering,* Second Edition, McGraw-Hill, New York.

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

2.3.3 WATER QUALITY

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 water-quality characteristics of surface-water bodies and groundwater aquifers that could (1) affect plant-water use and effluent disposal or (2) be affected by the construction or operation of the proposed project. The scope of the review directed by this plan should include consideration of site-specific and regional data on the physical, chemical, and biological water-quality characteristics of ground and surface water in sufficient detail to provide the basic data for other reviews dealing with the evaluation of construction or operational water-quality impacts to water bodies, aquifers, aquatic ecosystems, and water use.

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 2.4.2. Provide sufficient detail in this ESRP to support the description of the aquatic environment in ESRP 2.4.2.

- ESRPs 3.3.1 and 3.3.2. Provide descriptive water-quality information in these ESRPs in sufficient detail to support the descriptions of the plant water treatment in ESRPs 3.3.1 and 3.3.2.

- ESRP 3.6. Provide descriptive water-quality information in this ESRP in sufficient detail to support the description of the characteristics of the plant water treatment systems discharge in ESRP 3.6.

- ESRPs 4.2.2, 4.3.2, 5.2.2, 5.3, and 5.5. Provide descriptive water-quality information in these ESRPs in sufficient detail to support the assessment of the water-use and aquatic ecosystem impacts of plant construction and operation proposed by the reviewers for ESRPs 4.2, 4.3, 5.2, 5.3, and 5.5.

- ESRPs 6.5.2 and 6.6. Provide descriptive water-quality information in these ESRPs in sufficient detail to support the assessment of the adequacy of the baseline aquatic ecology and water-quality monitoring program in ESRPs 6.5.2 and 6.6.

Data and Information Needs

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

- the mean, range, and temporal and spatial variations of the surface-water and groundwater-quality characteristics

  - For surface waters: water temperature, suspended solids, total dissolved solids, hardness, turbidity, color, odor, conductivity, dissolved oxygen, biological oxygen demand (BOD), chemical oxygen demand (COD), phosphorus forms (total and orthophosphate), nitrogen forms (ammonia, nitrate, nitrite, organic), alkalinity, chlorides, sulfate, sodium, potassium, calcium, magnesium, heavy metals (e.g., Hg, Pb), pH, phytoplankton (chlorophyll *a*), and indicator microorganisms (e.g., total coliform, fecal coliforms, fecal streptococci) (from the environmental report [ER] and from consultation with Federal, State, regional, local, and affected Native American tribal agencies)

  - For groundwaters: the above surface-water data, minus phytoplankton and with silica, iron, carbon dioxide, and bicarbonate added (from the environmental report [ER] and from consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- other site-specific water-quality characteristics (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- descriptions, such as 303(d) lists, of pre-existing aquatic environmental stresses and their effects on surface or groundwater quality for waters that interact with the plant (e.g., water bodies at or near the site that do not meet established water-quality standards) (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- descriptions of pollutant sources with discharges to water that may interact with the plant, including locations relative to the site and the affected water bodies, and the magnitude and nature of the pollutant discharges, including spatial and temporal variations (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- comparison of standard practices to plant waste water treatment system (AWWA 1990)

- State 303(d) lists of impaired waters.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of water quality in water bodies affected by the proposed project 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 122-133 with respect to the National Pollutant Discharge Elimination System (NPDES) permit conditions for discharges including storm-water discharges

- 40 CFR 147 with respect to restrictions on waste disposal options

- 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 the disposal and storage of pesticides and pesticide containers

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

- 40 CFR 403 with respect to waste effluents

- 40 CFR 423 with respect to effluent limitations on existing and new point sources

- 40 CFR 700-716 with respect to practices and procedures for managing toxic chemicals

- State 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 should 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 (to the degree possible in conjunction with the permitting authority and other agencies having relevant expertise) should 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 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 description of water-quality characteristics, surface-water bodies, and groundwater aquifers is discussed in the following paragraph:

A detailed and thorough description of the water quality is essential for evaluating potential impacts to the environment that may result from plant construction or operation. This ESRP contains background water-quality material that is essential for understanding the impacts on water use, water quality, land use, ecological systems, and monitoring programs during both construction and operation.

III. REVIEW PROCEDURES

The reviewer's analysis of water quality should be closely linked with the reviews described in the Review Interfaces section of this ESRP to ensure that the physical, chemical, and biological water-quality parameters that could affect or be affected by plant construction or operation have been described. With this in mind, the reviewer should take the following steps:

(1) Identify the location and spatial distribution of the physical, chemical, and biological characteristics, the monthly and annual ranges, and the historical extremes of those water-quality characteristics that could potentially affect or be affected by plant construction or operation.

- Adjust the data for present day conditions.

- If historical observations are incomplete or unavailable for the locations of concern, obtain these data through consultation with the applicant or with appropriate resource agencies.

(2) Determine the presence of environmental stresses related to existing water quality.

- Determine stresses on the bases of the quality criteria requirements of other water users, as indicated by the approved water-use classification (such as 303(d) lists) or water-resource planning documents for the water body in question.

- As part of the determination, consult the historical literature addressing water-quality issues for the water body in question.

(3) When applicable, discuss the water-quality conditions, water rights, and agreements as they affect water-quality and water-resource plans for the site and vicinity with Federal, State, regional, local, and affected Native American tribal water resource and pollution control and monitoring agencies.

(4) Obtain the information primarily from the applicant's

- ER
- responses to questions to the applicant
- consultation with Federal, State, regional, local, and affected Native American tribal agencies.

Use sources of data, such as river basin planning organizations, and State and Federal agencies, such as the EPA, the U.S. Army Corps of Engineers, and the U.S. Geological Survey, if additional information or verification is deemed necessary.[a]

(a) If site-specific data are unavailable, the following sources are recommended:
- comprehensive framework studies of water and related lands by river-basin planning organizations and regional interagency committees
- Storage and Retrieval System for Water and Biological Data (STORET) water-quality data, time period, and water-quality constituents from the EPA
- reports and data from State agencies, including ecology, conservation, public health, fish and game, forestry, agriculture, water resources, State lands, State engineer, and highway departments and special natural resources commissions (names and functions vary from State to State), and from Native American tribes.

(5) Ensure that

- data are sufficient to provide quantitative information on the physical, chemical, and biological water-quality characteristics potentially affecting or affected by plant construction or operation

- the water-quality descriptions are sufficient, with respect to relevancy, completeness, reliability, and accuracy for input to the impact assessments of other sections

- Federal, State, regional, local, and affected Native American tribal agencies appropriate to the objectives of this environmental review have been consulted.

(6) When evaluating the adequacy of this material,

- consult the applicable standards and guides for this environmental review and use the site visit and/or consultations to permitting agencies to evaluate the completeness of the water-quality descriptions

- evaluate, when necessary, the collection of additional data, the verification of data, and the substantiation of the methodology used to estimate water-quality parameters.

(7) Include the appropriate depth and extent of the input to the environmental impact statement (EIS) as governed by the water-quality characteristics that could affect or be affected by plant construction or operation and by the nature and magnitude of the expected impacts. The following information should be included as input to the EIS:

- descriptions of site and vicinity surface-water and groundwater quality that could affect or be affected by plant construction and operation. The description may consist of statistical summaries of the water-quality characteristics, including mean, mean low and high, and historical low and high values (as available) for the site and vicinity. The data included should be commensurate with the anticipated impacts. Figures may be used to show long-term and seasonal trends, such as variations in dissolved oxygen and nutrient concentrations and pH variations.

- a description of the water-quality-related environmental stresses in the site and vicinity.

IV. EVALUATION FINDINGS

The reviewer should verify that sufficient information has been provided to support the analyses required in subsequent reviews.

The depth and extent of the input to the environmental impact statement (EIS) will be governed by the nature of the surface-water bodies and groundwater aquifers in the region and the extent to which they could affect or be affected by plant construction or operation. The following information should be included in the EIS:

- a description of the applicable water quality regulations
- a description of the existing water quality in vicinity of the plant
- a description of the potential impacts of the water on plant operations
- a description of the potential impacts of the plant on water quality.

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 122-133, Relevant sections of "The NPDES Pollution Elimination System."

40 CFR 147, "State Underground Injection Control Programs."

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."

40 CFR 700-716, Relevant sections of "Toxic Substances Control Act."

American Water Works Association (AWWA). 1990. *Water Quality and Treatment*, 4th Edition, McGraw-Hill, New York.

Federal Water Pollution Control Act (FWPCA), as amended, 33 USC 1252 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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.4 ECOLOGY

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 ecological description portions of the environmental impact statement (EIS). The scope of the paragraph covered by this plan introduces the material to be presented from the reviews conducted under ESRPs 2.4.1 and 2.4.2.

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 introductory paragraph prepared under this ESRP should be consistent with the intent of the following regulation:

- 10 CFR 51.70(b) with respect to preparation of an EIS that is concise, clear and 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 ecology description application of this criterion 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 2.4.1 and 2.4.2. This paragraph 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

2.4.1 TERRESTRIAL ECOLOGY

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 terrestrial environment and biota of the site, transmission corridors, and offsite areas likely to be impacted by the construction, maintenance, or operation of the proposed project. This review should provide input to reviews dealing with evaluation of construction or operational impacts on terrestrial ecosystems and to other reviews that are concerned with land use.

The scope of the review directed by this plan includes identification and description of species composition, spatial and temporal distribution, abundance, and other structural and functional attributes of biotic assemblages that could be impacted by the proposed action. The scope should also include the identification of any "important" terrestrial natural resources (see Table 2.4.1-1 on p. 2.4.1-7) and the location of wildlife sanctuaries and natural areas that might be impacted by the proposed action.

Review Interfaces

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

- ESRP 2.2.1. Obtain information about land use of the site and vicinity to complete the description of the site's terrestrial ecology.

- ESRP 2.2.2. Obtain information about land use of the transmission line corridors, access corridors, and other pertinent offsite areas to complete the description of the site's terrestrial ecology.

- ESRP 2.8. Provide appropriate information on the principal terrestrial ecological features of the site and vicinity in sufficient detail to allow for an evaluation of the cumulative impacts to the terrestrial ecosystems resulting from related Federal project activities.

- ESRP 4.1.1. Provide appropriate information on the principal terrestrial ecological features of the site and vicinity in sufficient detail to allow for an evaluation of land-use impacts resulting from site and vicinity construction.

- ESRP 4.1.2. Provide appropriate information on the principal terrestrial ecological features of the transmission corridors and offsite areas in sufficient detail to allow for an evaluation of land-use impacts resulting from transmission corridor and other offsite facility construction.

- ESRP 4.3.1. Provide information on the principal terrestrial ecological features of the site and vicinity in sufficient detail to allow for an evaluation of the impacts on the terrestrial ecosystems resulting from construction.

- ESRPs 5.1.1 and 5.1.2. Provide information on the principal terrestrial ecological features of the site and vicinity in sufficient detail to allow for an evaluation of land-use impacts resulting from operation of the power station.

- ESRP 5.3.3.2. Provide information on the site's terrestrial ecology so that a description of impacts on the terrestrial ecosystem from operation of the heat-dissipation systems can be completed.

- ESRP 5.4.4. Provide information on the principal terrestrial ecological features of the site and vicinity in sufficient detail to allow for the evaluation of the radiological impacts on the terrestrial ecosystem due to normal plant operation.

- ESRP 5.6.1. Provide information on the site's terrestrial ecology so that an evaluation of impacts on the terrestrial ecosystem from operation or maintenance of the transmission system can be completed.

- ESRP 6.5.1. Provide information on the principal terrestrial ecological features of the site and vicinity in sufficient detail to allow for the evaluation of the terrestrial 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. Refer to Table 2.4.1-1 (see p. 2.4.1-7) for a listing of species and habitat criteria for designation of "important" species and resources. The following data or information should be obtained:

- a map that identifies “important” terrestrial habitats on and in the vicinity of the site

- a description and map of the area occupied by each natural and man-made habitat type (from the environmental report [ER])

- U.S. Geological Survey (USGS) topographic maps of the site (7½ min. scale, when available) (from the general literature)

- list and description of “important” species and their spatial and temporal distributions on and in the vicinity of the site, including, as appropriate, their relative abundance, critical habitat, and their life histories—critical life stages, biologically significant activities, seasonal habitat requirements and population fluctuations, food chain, and other interspecific relationships (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- list of species that are of concern as disease vectors or pests. Detailed field surveys of such species are not needed (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies).

- a qualitative estimate of the importance of habitat of threatened, endangered, and other “important” species on and in the vicinity of the site relative to the habitat of such species throughout their entire range (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- locations of travel corridors for “important” terrestrial species and alternate routes for those corridors that could potentially be blocked by use of the site (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- a description of natural and man-induced effects (e.g., farming, logging, grazing, burning), preexisting environmental stresses (e.g., infestations, epidemics, catastrophes), and the current ecological conditions that are indicative of such stresses (from the ER)

- a description and location of any ecological or biological studies of the site or its environs that are recent or currently in progress (from the ER and the general literature)

- documentation that the applicant has consulted with the appropriate Federal and State agencies (e.g., as required by the Fish and Wildlife Coordination Act) and affected Native American tribes (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies).

The following data and information about transmission corridors and offsite areas should be obtained:

- a list of “important” terrestrial habitats and a map that identifies these habitats along routes of transmission and access corridors from the station site to interconnecting points on the high voltage system

- major vegetation types within the proposed corridors (from the ER, site visit, and through consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- a list of “important” species known to occur within and adjacent to the proposed corridors, their spatial and temporal distributions, critical habitats (as appropriate), and their life histories (including critical life stages, biologically significant activities, seasonal habitat requirements and population fluctuations, food chain and other interspecific relationships) (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- where proposed transmission lines cross important waterfowl areas, a list of descriptions of these areas and data on the local abundance and distribution of waterfowl, their seasonal status, and local flight patterns (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- lists of species that are of concern as disease vectors or pests. Detailed field surveys of such species are not needed (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- a more-detailed examination of any segment of the rights-of-way determined to be particularly sensitive to impacts of construction

- a summary of any preexisting environmental stress from such sources such as pollutants, as well as pertinent ecological conditions suggestive of such stresses. A discussion of histories of any infestations, epidemics, or catastrophes (caused by natural phenomena) that have had a significant impact on biota in the vicinity of the transmission corridors should also be included.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of terrestrial ecology on and in the vicinity of the site and transmission corridors are based on the relevant requirements of the following:

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

- 10 CFR 52, Subpart A, with respect to descriptions of the 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 the bald or golden eagle, dead or alive, without a permit

- Endangered Species Act of 1973 with respect to identifying threatened and endangered species, critical habitats, 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 of development 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 or other parts of nests and 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 positions and specific criteria necessary to meet the regulations as identified above are as follows:

- 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 their environs should be sufficiently well-known to allow reasonably certain predictions that there would be no unacceptable or unnecessary deleterious impacts on populations of important species or on ecological systems with which they are associated from the construction or operation of a nuclear power station at the site. The reviewer should ensure that the applicant's description of the site and transmission corridors identifies important species or ecological systems that could potentially be impacted by station and transmission corridor construction or operation.

- 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 are included in the ER.

Technical Rationale

The technical rationale for evaluating the applicant's description of the area's terrestrial ecology is discussed in the following paragraph:

A detailed and thorough description of the terrestrial ecology in the vicinity of the power station site and associated transmission corridors is essential for the evaluation of potential impacts to the terrestrial environment that may result from plant construction or operation. Use of these acceptance criteria should help ensure inclusion of the terrestrial ecological attributes most needed to predict impacts.

III. REVIEW PROCEDURES

The reviewer should ensure that the ecological information is adequate to serve as a basis for assessment of the impacts of design and siting of the plant, and plant construction and operation. In evaluating the adequacy of the description of terrestrial resources of the site and offsite areas, the reviewer should consult the applicable acceptance criteria of this ESRP. Within these criteria, the reviewer will find a framework of those descriptive features of terrestrial resources judged adequate for most situations of nuclear power station siting. The reviewer should also become familiar with the provisions of the legislation listed in this ESRP.

With these guidelines in mind, the reviewer should take the following steps:

(1) Identify the species and habitats that will be considered "important" ecological resources of the site, vicinity, transmission corridors, and offsite areas for evaluation of potential impacts on them, using Table 2.4.1-1 as a reference.

(2) Consult with local offices of the appropriate Federal, State, regional, local, and affected Native American tribal agencies to determine the possible presence of such species.

(3) Identify the threatened and endangered species that, based on known distributions, could be present within these areas, but that have not been recorded by documented observations.

(4) In the case of commercially or recreationally valuable species, list the types of wildlife and plants that could be adversely impacted by the proposed action, and in addition to the applicant's ER, consult with State or local agencies or organizations that maintain records of harvest levels of these species.

(5) Review the available site-specific data for adequacy, accuracy, and completeness.

IV. EVALUATION FINDINGS

The depth and extent of the input to the EIS should be governed by the kinds of terrestrial ecological resources that could be affected by plant construction or operation and by the nature and magnitude of the expected impacts to these resources. The reviewer should prepare input to the EIS descriptions of the site and offsite areas potentially affected by the proposed project. The input should be brief and should include the following information:

- the principal terrestrial ecological features of the site and vicinity, transmission and access corridors, and offsite areas, with emphasis on the communities that will be potentially affected by proposed project construction, operation, or maintenance. This information should be based on an analysis of at least one full year of data, to reflect seasonal variations in terrestrial populations. Thus, the extent of discussion of various plant and animal communities should be adequate to support the impact assessments for ESRP Chapters 4.0 and 5.0.

Table 2.4.1-1. Important Species and Habitats

Species	Habitat
Rare species • Listed as threatened or endangered at 50 CFR 17.11 (Fish and wildlife) or 50 CFR 17.12 (Plants). This information may also be found via the Internet at the U.S. Fish and Wildlife Homepage in GEn&SIS. • Proposed for listing as threatened or endangered, or is a candidate for listing in the most current list of such species as published in the *Federal Register*. This information may also be found via the Internet at the U.S. Fish and Wildlife Homepage in GEn&SIS. • Listed as a threatened, endangered, or other species of concern by the State or States in which the proposed facilities are located Commercially or recreationally valuable species Species that are essential to the maintenance and survival of species that are rare and commercially or recreationally valuable (as defined previously) Species that are critical to the structure and function of the local terrestrial ecosystem Species that may serve as biological indicators to monitor the effects of the facilities on the terrestrial environment	Wildlife sanctuaries, refuges, or preserves, if they may be adversely affected by plant or transmission line construction or operation Habitats identified by State or Federal agencies as unique, rare, or of priority for protection, if these areas may be adversely affected by plant or transmission line operation and maintenance Wetlands (Executive Order 11990), floodplains (Executive Order 11988), or other resources specifically protected by Federal regulations or Executive Orders, or by State regulations Land areas identified as "critical habitat" for species listed as threatened or endangered by the U.S. Fish and Wildlife Service

- wildlife sanctuaries, natural areas, and related areas that could be affected

- a discussion of "important" species that may be affected by plant or transmission corridor construction or operation. Estimates of their abundance should be provided when appropriate. Special habitat needs, such as cover, forage, and prey species, should be emphasized if the proposed project would potentially disrupt these needs.

- a summary of the consultations with appropriate Federal, State, regional, local, and affected Native American tribal agencies, including the U. S. Fish and Wildlife Service (through the regional director) and the director of the State Fish and Wildlife agency.

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, Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)."

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statements—production and utilization facilities: draft environmental impact statement—construction permit."

10 CFR 51.95, "Final environmental impact statements—production and utilization facilities: supplement to final environmental impact statement."

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

10 CFR 52.79, "Contents of application; technical information."

50 CFR 17.11, "Fish and wildlife."

50 CFR 17.12, "Plants."

Bald and Golden Eagle Protection Act of 1940, as amended, 16 USC 668 et. seq.

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

Executive Order 11988, "Floodplain Management."

Executive Order 11990, "Protection of Wetlands."

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). 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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.4.2 AQUATIC ECOLOGY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of the aquatic environment and biota at and in the vicinity of the site and other areas likely to be impacted by the construction, maintenance, or operation of the proposed project. This review should provide input to reviews dealing with evaluation of construction or operational impacts on aquatic ecosystems and to other reviews that deal with the aquatic environment.

The scope of the review directed by this plan should include the spatial and temporal distribution, abundance, and other structural and functional attributes of biotic assemblages on which the proposed action could have an impact. The review should also identify any "important" (see Table 2.4.2-1) or irreplaceable aquatic natural resources and the location of sanctuaries and preserves that might be impacted by the proposed actions.

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 to complete the description of the site and vicinity's aquatic ecology.

- ESRP 2.3.3. Obtain information about water-quality areas to complete the description of the site and vicinity's aquatic ecology.

- ESRP 4.3.2. Provide information on the principal aquatic ecological features of the site and vicinity in sufficient detail to allow for an evaluation of the impacts to the aquatic ecosystems resulting from construction.

- ESRP 5.3.1. Provide information on the principal aquatic ecological features of the site and vicinity in sufficient detail to allow for an evaluation of the impacts of the cooling system intake structures.

- ESRP 5.3.1.1. Provide information regarding the site's aquatic ecology so that a description and assessment of the hydrodynamics and physical impacts of the intake structures can be completed.

- ESRP 5.3.1.2. Provide information regarding the site's aquatic ecology so that a description of impacts from operation of the intake system can be completed.

- ESRP 5.3.2. Provide information on the principal aquatic ecological features of the site and vicinity in sufficient detail to allow for an evaluation of the impacts of the cooling system discharge structures.

- ESRP 5.3.2.1. Provide information regarding the site's aquatic ecology so that a description and assessment of the plant's hydrothermal discharge and associated physical impacts can be completed.

- ESRP 5.3.2.2. Provide information regarding the site's aquatic ecology so that a description of impacts from operation of the discharge system can be completed.

- ESRP 5.6.2. Provide information regarding the site's aquatic ecology so that an evaluation of the impacts to aquatic ecosystems from transmission facility operation and maintenance can be completed.

- ESRP 6.5.2. Provide information regarding the site's aquatic ecology so that an evaluation of monitoring programs as they relate to the aquatic ecology of the site can be completed.

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:

- characterization of the aquatic environment of the water body and onsite streams, including the following information categories:

- biological (from the environmental report [ER] and the general literature)

- hydrological (from ESRP 2.3.1)

- physiochemical (from ESRP 2.3.3).

- maps showing “important” aquatic habitats (“important” habitat defined in Table 2.4.2-1 [see p. 2.4.2-7]) of the site and vicinity

- the temporal and spatial (including depth) distribution and abundance of “important” aquatic species, especially in the discharge area and receiving water body. Such critical life-support requirements as spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes (to the extent that power plant construction or operation is expected to affect these parameters). Map where applicable (from the ER, the general literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- the location and value of the commercial and sport fisheries and the seasonal distribution of harvest by species (from the ER, the general literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- endangered and threatened aquatic species that are known to be present or could potentially occur onsite and an identification of their other locations and critical habitats within the region. Also identify specific habitat requirements (e.g., thermal tolerance ranges), community interrelationships, and relative abundance (from the ER, the general literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies).

- key aquatic indicator organisms expected to gauge changes in the distribution and abundance of species populations that are particularly vulnerable to impacts from plant construction or operation (from ER)

- the presence of “nuisance” species such as *Corbicula* sp. or *Mytilus* sp. onsite or in the vicinity of the plant and that are capable of blocking or bio-fouling the cooling water intake system or that can cause other significant problems (from ER)

- the relative significance of important aquatic habitats in a regional context (from the ER, the general literature, and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- a description of onsite natural, man-induced, and pre-existing environmental stresses, and the current ecological conditions that are indicative of such stresses (from the ER).

The following data or information about transmission corridors and offsite areas should be obtained only when the proposed transmission corridors and offsite areas intersect or are adjacent to aquatic resources:

- a map and description of the location and extent of threatened or endangered or other "important" aquatic species that are known or expected to be present in the vicinity of the transmission corridors together with any specific habitat requirements or community interrelationships (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

- any physical, chemical, and biological factors known to influence distribution and abundance of threatened and endangered aquatic life in the vicinity of the transmission corridors (from the general literature)

- documentation that the applicant has consulted with the appropriate Federal, State, regional, local, and affected Native American tribal agencies (e.g., as required by the Fish and Wildlife Coordination Act) (from the ER)

II. ACCEPTANCE CRITERIA

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

- 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 environmental impact statements (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

- 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 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

- Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water 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 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 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 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 collects baseline data used to compare subsequent data to evaluate plant construction and operation impacts. The reviewer should ensure that the applicant's measurement of conditions before site preparation includes all environmental parameters necessary to evaluate impacts during station operation, as well as during site preparation and construction.

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (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 that there would be no unacceptable or unnecessary deleterious impacts on populations of important species or on ecological systems with which they are associated from the construction or operation of a nuclear power station at the site. The reviewer should ensure that the applicant's description of the site and transmission corridors identify important species or ecological systems that could potentially be impacted by station and transmission corridor construction or operation.

Technical Rationale

The technical rationale for evaluating the applicant's description of the area's aquatic ecology is discussed in the following paragraph:

A detailed and thorough description of the aquatic ecology in the vicinity of the power station site and associated transmission corridors is essential for the evaluation of potential impacts to the aquatic environment that may result from plant construction or operation. Use of the above acceptance criteria will help ensure inclusion of the aquatic ecological attributes most needed to predict impacts.

III. REVIEW PROCEDURES

The reviewer should ensure that the regional and site-specific aquatic ecological information is adequate to serve as a basis for assessment of the effects of design and siting of the plant, construction, and operation. In assessing the adequacy of the description of aquatic resources of the site and offsite areas, the reviewer should consult the applicable acceptance criteria of this ESRP section. Within these

criteria, the reviewer may find a framework of those descriptive features of aquatic resources judged adequate for most situations of nuclear power station siting. The reviewer should also become familiar with the provisions of the legislation listed in the "Acceptance Criteria" section.

With these guidelines in mind, the reviewer should take the following steps:

(1) Identify the species and habitats that will be considered "important" ecological resources of the site, vicinity, transmission corridors, and offsite areas for evaluation of potential impacts on them, using Table 2.4.2-1 as a reference.

(2) Consult with local offices of the appropriate Federal agencies and the appropriate State agencies to verify the possible occurrence of such species.

(3) Identify the threatened or endangered species that, based on known distributions, could be present within these areas, but that have not been recorded by documented observations.

(4) In the case of commercially or recreationally valuable species, list the types of wildlife and plants that could be adversely impacted by the proposed action, and in addition to the applicant's ER, consult with State or local agencies or organizations that maintain records of harvest levels of these species.

(5) Review the available site-specific data for adequacy, accuracy, and completeness.

IV. EVALUATION FINDINGS

The depth and extent of the input to the EIS should be governed by the kinds of aquatic ecological resources that could be affected by plant construction or operation and by the nature and magnitude of the expected impacts to these resources. The reviewer should prepare as input to the EIS descriptions of the onsite and offsite areas potentially affected by the proposed project. The input should be brief and should contain the following information:

- the principal aquatic ecological features of the site and vicinity and those sensitive offsite areas affected by transmission and access corridors and related facilities, with emphasis on the communities of the ecosystem that will be potentially affected by project construction, operation, or maintenance. This information should be based on an analysis of at least one full year of data to reflect seasonal variations in aquatic populations. Thus, the extent of discussion of various biotic components should be in proportion to the estimated severity of impacts and should be adequate to support the assessment of ESRP Chapters 4.0 and 5.0.

- descriptions of environmental or man-induced stresses to aquatic biota at the existing site and vicinity

Table 2.4.2-1. Important Species and Habitats

Species	Habitat
Rare species • Listed as threatened or endangered at 50 CFR 17.11 (Fish and wildlife) or 50 CFR 17.12 (Plants). This information may also be found via the Internet at the U.S. Fish and Wildlife Homepage in GEn&SIS. • Proposed for listing as threatened or endangered, or is a candidate for listing in the most current list of such species as published in the *Federal Register*. This information may also be found via the Internet at the U.S. Fish and Wildlife Homepage in GEn&SIS. • Listed as a threatened, endangered, or other species of concern by the State or States in which the proposed facilities are located Commercially or recreationally valuable species Species that are essential to the maintenance and survival of species that are rare and commercially or recreationally valuable (as defined previously) Species that are critical to the structure and function of the local terrestrial ecosystem Species that may serve as biological indicators to monitor the effects of the facilities on the terrestrial environment	Wildlife sanctuaries, refuges, or preserves, if they may be adversely affected by plant or transmission line construction or operation Habitats identified by State or Federal agencies as unique, rare, or of priority for protection, if these areas may be adversely affected by plant or transmission line operation and maintenance Wetlands (Executive Order 11990), floodplains (Executive Order 11988), or other resources specifically protected by Federal regulations or Executive Orders, or by State regulations Land areas identified as "critical habitat" for species listed as threatened or endangered by the U.S. Fish and Wildlife Service

- a discussion of "important" aquatic species that may be affected by plant or transmission corridor construction or operation. Estimates of their abundance should be provided where appropriate. Special habitat and forage needs should be emphasized, if the proposed project would potentially disrupt these.

- a summary of consultations with appropriate Federal, State, regional, local, and affected Native American tribal agencies, including the U.S. Fish and Wildlife Service (through the regional director), and the director of the State fish and wildlife agency.

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."

50 CFR 17.11, "Fish and wildlife."

50 CFR 17.12, "Plants."

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

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

Executive Order 11988, "Floodplain Management."

Executive Order 11990, "Protection of Wetlands."

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. 92-522, 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.

Rivers and Harbor Appropriations 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.

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

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.6 GEOLOGY

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the use (by reference) of the staff's safety evaluation report (SER) or site safety evaluation report (SSER) for all descriptions of site and vicinity geology. Reference to these documents should be made in the environmental impact statement (EIS), and no description of site and vicinity geology will be required.

Review Interfaces

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

- ESRPs 4.1, 5.1.1, and 5.1.2. Provide notification to the reviewers when there is any potential for geologic environmental impact.

Data and Information Needs

None.

II. ACCEPTANCE CRITERIA

None.

Technical Rationale

The potential for geological impacts is small and will be evaluated as part of the safety evaluation.

III. REVIEW PROCEDURES

The potential for geological environmental impacts (e.g., subsidence from cooling pond loading) is small, and the staff's experience has been that actual occurrence of such impacts is infrequent. Further, any such potential would be established and evaluated during the staff's safety evaluation and described in the staff's SER or SSER. On this basis, no environmental review of geology is required, but the reviewer's analysis should consist of the following two steps:

(1) Consult with the staff's safety evaluation reviewers to determine if there is any potential for geological environmental impact.

(2) When any such impacts can be predicted, notify the reviewers for ESRPs 4.1 and 5.1 to develop, in consultation with the safety reviewers, an analysis and evaluation of the potential impacts.

IV. EVALUATION FINDINGS

Evaluation findings are not required. The reviewer should provide the following statement for inclusion in the EIS:

> The staff's description of site and vicinity geological features and the detailed analyses and evaluations of geological, seismological, and geotechnical data as required for an assessment of (1) site suitability for a plant of the general size and type proposed or (2) site-safety issues related to the specific proposed plant are, or will be, included in the staff's SSER and/or SER.

In addition, when any potential for geological environmental impact has been determined, the input should note that this determination has been made and identify the appropriate EIS section that contains an analysis and evaluation of the predicted 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

None.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.7 METEOROLOGY AND AIR QUALITY

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 meteorology of the site and surrounding area and the characterization of atmospheric transport and diffusion processes (i.e., airflow trajectories, deposition characteristics) to a distance of 80 km (50 mi) from the station. This review should provide input to reviews dealing with evaluation of construction and operational impacts that involve meteorology.

The scope of the review directed by this plan includes (1) description of the regional climatological characteristics to be considered in the assessment of the design of the plant and its heat dissipation system; (2) description of the meteorological characteristics of the site and vicinity, using data from the onsite meteorological monitoring program, to be considered in the assessment of the impacts of the heat-dissipation system; (3) identification of the regional atmospheric transport and diffusion characteristics to be considered in the assessment of the population dose commitments likely to result from plant operation; (4) identification of the local atmospheric transport and diffusion characteristics to be considered in the assessment of the individual and population doses likely to result from plant operation; and (5) assessment of specific impacts on the atmospheric 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 2.1. Obtain a description of the plant location.

- ESRPs 3.4.1 and 3.4.2. Obtain descriptions of the cooling system and relevant components for use in determining potential impacts of heat dissipation on the atmosphere.

- ESRP 3.5. Obtain descriptions of potential release points for radioactive effluents for use in atmospheric transport and diffusion calculation.

- ESRP 3.6.3. Obtain descriptions of non-radiological emission to the atmosphere for evaluation of the impacts of plant construction and operation on air quality (include emissions from vehicles).

- ESRP 4.4.1. Provide estimates of the impact of construction activity on air quality.

- ESRP 5.1.1 and 5.8.1. Provide estimates of the impacts of plant operation on air quality.

- ESRP 5.3.2.1. Provide a description of the meteorology at the site of the proposed plant.

- ESRP 5.3.3.1. Provide meteorological data as required to analyze and evaluate heat dissipation system effects on the atmosphere.

- ESRPs 5.4.1 and 5.4.2. Obtain locations of the nearest receptors in each 22½° sector for atmospheric transport and diffusion calculations. Provide summaries of relative concentration and relative deposition values estimated or approved by the staff and a comparison of the values determined by the staff and the applicant, if they are substantially different from each other.

- ESRP 6.2. Provide an assessment of the adequacy of air-sampling locations and indicate additional air-sampling locations, if appropriate.

- ESRP 6.4. Provide an assessment of the adequacy of meteorological monitoring.

- ESRP 7.1 and 7.2. Provide meteorological data to analyze and evaluate the effects of plant accidents involving radioactive material.

- ESRP 9.4.1. Provide meteorological data to evaluate heat dissipation of alternative 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. Adequate characterization of atmospheric transport and diffusion processes within 80 km (50 mi) of the plant is necessary, and may include presentation of meteorological data from stations farther than 80 km (50 mi) when this information can provide additional clarification of the mesoscale atmospheric transport and diffusion processes. At least one annual cycle from the onsite meteorological program should be

used for atmospheric transport and diffusion calculations. Sources of meteorological information, in addition to the onsite meteorological program, should include National Weather Service (NWS) stations, other meteorological programs that are well maintained and well exposed (e.g., other nuclear facilities, university, and private meteorological programs), and supplementary meteorological facilities established by the applicant (or others) to characterize relevant conditions at critical onsite and offsite locations. All data used in calculations of atmospheric transport and diffusion estimates should be concurrent with the onsite data collection periods. Onsite data should be presented as hourly averages in the format described in Appendix A to this ESRP.

The site and regional meteorology data listed below should be fully documented and substantiated as to the validity of their representation of expected long-term conditions at and near the site. These data should be taken from onsite meteorological measurements and nearby representative stations, and for relevant stations within 80 km (50 mi) of the site. Regional climatological data, such as averages and extremes, should be based on a period of record that represents long-term conditions in the area and examination of available historical information. The following site and regional data or information should be obtained:

- a description of the general climate of the region with respect to types of air masses, synoptic features (high- and low-pressure systems and frontal systems, and principal storm tracks), general airflow patterns, temperature and humidity characteristics, precipitation, and relationships between synoptic and mesoscale (e.g., land-sea [lake] breeze regimes, atmospheric processes and local [site] meteorological conditions) (from the environmental report [ER])

- a description of regional air quality, including non-attainment or maintenance areas

- a description (including seasonal and annual frequencies) of the severe weather phenomena (e.g., tornadoes, hurricanes, thunderstorms, droughts) and adverse air quality conditions (e.g., SO_x, NO_x, particulates, salt) affecting the site and vicinity (from the ER)

- monthly and annual air temperature and dewpoint temperature summaries, including averages, measured extremes, and diurnal range (from the ER)

- monthly cumulative frequency distributions of wet-bulb temperature based on long-term data from representative NWS stations (except for plants with once-through cooling) (from the general literature)

- monthly and annual summaries of precipitation, including averages and measured extremes, number of hours with precipitation, hourly rainfall-rate distribution, and monthly precipitation wind roses with precipitation rate classes (from the ER)

- monthly and annual summaries, including natural variability, of occurrences of heavy fog (visibility less than .4 km [.25 mi]), and appropriate summaries of other parameters to support the description of impacts resulting from the operation of a closed cycle heat dissipation system (from the ER)

- estimated monthly mixing-height data, including frequency and duration (persistence) of inversion conditions and methods used to provide the estimates (from the ER)

- monthly and annual wind roses using the wind speed classes provided in Regulatory Guide 1.23, *Onsite Meteorological Programs* (NRC 1972), and wind direction persistence summaries at all height(s) at which data on wind characteristics are applicable (from the ER)

- monthly and annual summaries of atmospheric stability (from the ER)

- topographic data presentation should include the following:

  - a map showing the detailed topographic features (as modified by the plant) on a large scale within an 8-km (5-mi) radius[(a)] of the station (from the ER)

  - a smaller-scale map showing topography within a 80-km (50-mi) radius of the station (from the ER)

  - a plot of maximum elevation versus distance from the center of the station in each of the sixteen 22½° sectors radiating from the station to a distance of 8 km (5 mi) (from the ER).

- hourly averages of wind speed and direction at all height(s) at which 8-km (5-mi) wind characteristics data are applicable and hourly averages of atmospheric stability (these data should be presented as hour-by-hour data [see Appendix A for an acceptable format] or monthly and annual joint-frequency distributions of wind speed and wind direction by atmospheric stability) (from the applicant upon request)

- detailed descriptions of the models and assumptions used to determine normalized concentration (χ/Q) and/or relative deposition (D/Q). The meteorological data used in these models should be identified. Guidance on acceptable models and necessary input data is provided in Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors* (NRC 1977) (from the ER).

- release-point characteristics and effluent characteristics (from ESRPs 3.5 and 3.6 through 3.6.3)

- receptor locations (from ESRP 5.4.1)

- χ/Q and/or D/Q at points of potential maximum concentration outside the site boundary, at points of maximum individual exposure, and at points within a radial grid of sixteen 22½° sectors (centered on true north, north-northeast, northeast, etc.) and extending to a distance of 80 km (50 mi) from the station. A set of data points should be located within each sector at increments of 0.4 km (0.25 mi)

(a) Exceptions to the 8-km (5-mi) site vicinity radius may be required when the land-use descriptions (ESRP 2.2.1) suggest that this is appropriate.

to a distance of 1.6 km (1 mi) from the plant, at increments of 0.8 km (0.5 mi) from a distance of 1.6 km (1 mi) to 8 km (5 mi), at increments of 4 km (2.5 mi) from a distance of 8 km (5 mi) to 16 km (10 mi), and at increments of 8 km (5 mi) thereafter to a distance of 80 km (50 mi). Estimates of χ/Q (undecayed and undepleted; depleted for radioiodines) and D/Q radioiodines and particulates should be provided at each of these grid points (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of site meteorology and air quality are based on the relevant requirements of the following:

- 10 CFR 50, Appendix I, with respect to calculation of air doses from gaseous emissions
- 10 CFR 51.70(b) with respect to the reliability of the meteorological and climatological information
- 10 CFR 51.71(d) with respect to compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, local, and affected Native American tribal agencies
- 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 100.10(c) and 10 CFR 100.20(c) with respect to meteorological conditions at the site and in the surrounding area
- 40 CFR 50 with respect to definition of criteria pollutants and National Ambient Air Quality Standards
- 40 CFR 51, Subpart W, with respect to requirements related to determination that the proposed Federal action conforms to applicable implementation plans
- 40 CFR 51, Appendix W, with respect to air-quality models
- 40 CFR 81, Subpart C, with respect to attainment status designations approved by the EPA.

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

- The description of the general climate of the region, including severe weather, should be based on published climatological summaries from nearby representative sites with long periods of record (see references in this ESRP).

- At least one annual cycle from the onsite meteorological program should be used to relate local meteorological conditions to local and regional climatology. Regulatory Guide 1.23, *Onsite Meteorological Programs* (NRC 1972), provides guidance related to onsite meteorology programs. ESRP 6.4 sets forth the staff review plan for evaluation of the onsite meteorological program.

- Atmospheric dispersion models and assumptions described in Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors* (NRC 1977), should be used for estimating relative atmospheric concentrations and relative deposition used in calculating individual and population doses from routine releases of radioactive effluents to the atmosphere.

- Atmospheric dispersion models and assumptions described in Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants* (NRC 1983), should be used for estimating relative atmospheric concentrations and relative deposition used in calculating individual doses from accidental releases of radioactive effluents to the atmosphere.

- Atmospheric dispersion models and assumptions promulgated by the EPA should be used for air quality assessments.

Technical Rationale

The technical rationale for evaluating the applicant's description of meteorology and air quality is discussed in the following paragraphs:

10 CFR 100.10(c)(2), 10 CFR 100.20(c)(2), and 10 CFR 52.17(a)(1) cover the consideration of meteorological conditions at or near the site. Published climatological summaries for the region provide a basis for defining the general climate of the site and establishing an appropriate context for evaluation of onsite meteorological data.

Onsite meteorological data are needed to evaluate the potential environmental impacts of heat dissipation to the atmosphere and the routine and accidental releases of radiation to the atmosphere. Onsite data for at least one full annual cycle are needed to ensure that the data are representative of site conditions.

Evaluation of compliance with 10 CFR 50, Appendix I, involves staff estimates of the consequences of routine releases of radioactive effluents from the plant. The staff considered various methods of calculating these consequences and presented acceptable methods in Regulatory Guide 1.111.

Evaluation of the environmental consequences of design-basis accidents involves staff estimates of atmospheric dispersion in the vicinity of the plant. The staff considered various methods of calculating these consequences and presented acceptable methods in Regulatory Guide 1.145.

Atmospheric dispersion models and assumptions for assessing the air quality impact of nonradiological atmospheric emissions are described by the EPA. Use of EPA models for air quality calculations will ensure consistency with calculations performed by other agencies.

III. REVIEW PROCEDURES

The reviewer's analysis of meteorology should be closely linked with the impact assessment review described by ESRPs 5.3.3.1 and 5.4 to establish the meteorological characteristics that are most likely to be affected.

To evaluate the applicant's climatological descriptions and meteorological data, the reviewer should compare them with the climatological data available from the National Climatic Data Center (NCDC) and information in climatological references. These references include

- standard climatological references, such as *Weather and Climate* (Koeppe and Delong 1958) and *Applied Climatology* (Griffiths 1963) that describe the relationship between climate and geography

- other climatological texts, such as *Boundary Layer Climates* (Oke 1978) and *The Climate Near the Ground* (Geiger, Aron, and Todhunter 1995), that describe local climate variability and climate modifications related to man's activities

- climate descriptions for specific regions in the United States that have been prepared by the U.S. Department of Commerce (1968), National Oceanic and Atmospheric Administration and that are found in publications such as *Climatic Atlas of the United States, Climates of the States,* and *Local Climatological Data Annual Summaries with Comparative Data.* These publications contain information on meteorological extremes as well as typical conditions.

- up-to-date climatological data and summaries that are available electronically from the NCDC through the Geographical Environmental & Siting Information System (GEn&SIS)

- severe-weather data related to extreme winds, hurricanes, and tornadoes that have been summarized by Cry (1965), Alaka (1968), Simpson and Lawrence (1971), Changery (1982a, b), Ramsdell and Andrews (1986), and Ramsdell et al. (1987)

- more recent severe weather statistics that are available through GEn&SIS and are updated monthly in *Storm Data* published by the NCDC.

To evaluate the applicant's atmospheric transport and dispersion modeling, the reviewer should compare it with the standard dispersion modeling techniques, such as

- atmospheric dispersion modeling techniques that are described in detail in texts including *Meteorology and Atomic Energy—1968* (Slade 1968), *Handbook on Atmospheric Diffusion* (Hanna,

Briggs, and Hosker Jr. 1982), *Atmospheric Science and Power Production* (Randerson 1984), and *Workbook of Atmospheric Dispersion Estimates: An Introduction to Dispersion Modeling* (Turner 1994)

- climatological data specifically related to air quality and atmospheric dispersion that are found in the summaries available from NCDC and in journal articles by Hosler (1961 and 1964) and Holzworth (1972).

Regional Climatological and Local Meteorological Characteristics

When analyzing regional and local meteorological characteristics, the reviewer should take the following steps:

(1) Assess the general climatic description of the region for completeness and accuracy.

- Evaluate climatic parameters such as air masses, general airflow, pressure patterns, frontal systems, and temperature and humidity conditions reported by the applicant by comparing them with standard references.

- Verify the applicant's description of the role of synoptic scale and mesoscale atmospheric processes on local (site) meteorological conditions by comparing it with the descriptions provided in standard references and the reviewer's knowledge of the area.

(2) Examine the regional meteorological averages and extremes, including severe weather phenomena and air quality conditions, to establish that the data represent site conditions by comparing

- concurrent offsite and onsite data (e.g., monthly averages of wind speed, wind direction frequency, and precipitation, and monthly averages and diurnal variations of temperature and humidity)

- offsite data for the concurrent period of onsite data with long-term (about 30 years) offsite data

- the locations of the stations with respect to major topographic features and airflow patterns (e.g., valley flow, land-sea (lake) breeze circulations, principal storm tracks).

(3) Evaluate the local (site) meteorological parameters and topographic descriptions of the site area to establish that the data represent conditions at the site and its immediate vicinity by examining the location of the onsite meteorological tower (and other local sources of meteorological data) with respect to local topographic characteristics that could impact local airflow patterns (e.g., local circulation conditions such as "drainage flow") and meteorological parameters such as temperature and humidity.

(4) Determine if the regional and local meteorological data are appropriate as bases for the applicant's evaluation of potential changes in normal and extreme values, severe weather phenomena, and air quality conditions resulting from station construction and operation. (This information may be cross-referenced from Chapter 5.0 of the applicant's ER.)

(5) Analyze the proposed terrain modifications (e.g., removal of trees, leveling of ground, installation of lakes and ponds) resulting from station construction and predict the potential effects of these modifications on local meteorological characteristics with respect to the adequacy of available data considering these modifications.

(6) Determine the adequacy of data on regional climatological and local meteorological conditions and phenomena as bases for assessing the effects on design and siting of the station and heat dissipation system and as bases for assessing the impact on the atmospheric environment resulting from station construction and operation.

(7) Review regional and local meteorological data for appropriateness as input to predictive models for assessing cooling system impacts on the atmospheric environment by considering the types and frequencies of available meteorological measurements, the elevations at which measurements are made, the selected cooling system design, and the height of effluent release to the atmosphere.

Meteorological Input to Individual Dose Assessment

When analyzing meteorological input to individual dose assessment, the reviewer should take the following steps:

(1) Obtain the following information from the ESRP reviewers listed below:

- ESRP 3.5—a description of release point characteristics (i.e., elevation above grade, inside vent or stack diameter, physical shape, flow rate, effluent temperature, exit velocity, release frequency, and duration and type of effluent) for each point of routine release of radioactive effluent to the atmosphere

- ESRP 5.4.1—the locations of the nearest receptors (cow, goat, vegetable garden, residence, and site boundary) in each 22½° sector.

(2) Compare the atmospheric transport and diffusion models used by the applicant for calculations of χ/Q and D/Q to transport and diffusion modeling concepts (as described in Regulatory Guide 1.111) applicable to local topographic and meteorological characteristics and to the type and mode of release appropriate to the plant.

(3) Examine atmospheric transport and diffusion parameters for applicability to local topographic and meteorological characteristics by considering the experimental bases for these parameters with respect to the local conditions.

(4) Compare the meteorological data provided by the applicant for use in the atmospheric transport and diffusion modes for compatibility with the models used and verify the completeness and adequacy of the description of local atmospheric transport and diffusion characteristics (as discussed in Regulatory Guides 1.23 and 1.111).

- Evaluate the meteorological data for appropriateness of heights of measurement of wind speed, wind direction, and atmospheric stability.

  - Winds measured at the 10-m level and temperature difference measurements (as an indicator of atmospheric stability) between the 10-m level and height of the building or vent are acceptable for consideration of ground-level releases.

  - For releases considered elevated, (1) winds reasonably representative of conditions at the height of release, and (2) temperature difference measurements reasonably representative of the atmospheric layer, into which the effluent will be released, are acceptable.

- Examine mixing height data for considerations of restrictions to the vertical spread of the effluent.

- Examine precipitation data for considerations of the effects of washout on estimates of atmospheric transport, diffusion, and deposition.

(5) Evaluate estimates of relative concentration (including consideration of radioactive decay during transport and depletion of radioiodines and particulates) and relative deposition (including the effects of wet deposition) used by the applicant for assessing the individual doses resulting from routine releases of radioactive effluent to the atmosphere to verify that these estimates are complete and appropriate to local conditions. Depending on the level of confidence in the applicant's model and considering the extent, applicability, and representative nature of the available meteorological data, the reviewer may make an independent analysis of relative concentration and relative deposition values at each receptor using the transport and dispersion models described in Regulatory Guide 1.111.

Meteorological Input to Population-Dose Assessment

When evaluating meteorological input to population dose assessment, the reviewer should take the following steps:

(1) Verify that the release point characteristics are the same as those used for input to the individual dose assessments.

(2) Compare the atmospheric transport and diffusion models used by the applicant for calculations of relative concentration and relative deposition with transport and diffusion modeling concepts (as described in Regulatory Guide 1.111) applicable to regional (i.e., out to a distance of 80 km from the site) modeling.

- Give special consideration to topographic and meteorological characteristics (narrow, deep valleys, land sea [lake] breeze regimes, restricted mixing heights, fumigation conditions, and low-level subsidence inversions of temperature) to ensure that they are applicable to the type and mode of releases from the plant.

- Examine the atmospheric transport and diffusion parameters for applicability to regional topographic and meteorological characteristics by considering the experimental bases for these parameters with respect to regional conditions.

(3) Compare the meteorological data provided by the applicant for use in the atmospheric transport and diffusion models for compatibility with the models used and verify the completeness and adequacy of the description of regional atmospheric transport and diffusion characteristics as discussed in Regulatory Guides 1.23 and 1.111.

- Evaluate meteorological data for appropriateness of heights of measurements of wind speed, wind direction, and atmospheric stability.

  - Winds measured at the 10-m level and temperature difference measurements to indicate atmospheric stability between the 10-m level and height of the building or vent are acceptable for consideration of ground-level releases.

  - For releases considered elevated, winds reasonably representative of conditions at the height of release and reasonable estimates of the temperature of the atmospheric layer into which the effluent will be released are acceptable.

- Examine mixing height data for considerations of restrictions to the vertical spread of the effluent.

- Examine precipitation data for considerations of the effects of washout on estimates of atmospheric transport and diffusion.

(4) Evaluate estimates of relative concentration (including consideration of radioactive decay during transport and depletion of radioiodines and particulates) and relative deposition used by the applicant for an assessment of the population doses resulting from routine releases of radioactive effluent to the atmosphere to verify that these estimates are complete and appropriate to regional conditions. These estimates should encompass all individuals living within 80 km of the facility. Depending on the level of confidence in the applicant's model and considering the extent, applicability, and representativeness of the available meteorological data, the reviewer may independently analyze

relative concentration and relative deposition values for 16 directions in segments of 0.8-1.6 km (0.5-1 mi), 1.6-3.2 km (1-2 mi), 3.2-4.8 km (2-3 mi), 4.8-6.4 km (3-4 mi), 6.4-8.0 km (4-5 mi), 8.0-16 km (5-10 mi), 16-32 km (10-20 mi), 32-48 km (20-30 mi), 48-64 km (30-40 mi), and 64-80 km (40-50 mi) using the transport and diffusion models described in Regulatory Guide 1.111.

Meteorological Input to Plant-Accident Assessments

When analyzing meteorological input to plant accident assessments, the reviewer should take the following steps:

(1) Compare the atmospheric transport and diffusion models used by the applicant for calculations of χ/Q and D/Q for accident consequence assessments to state-of-the-art transport and diffusion modeling concepts (as described in Regulatory Guide 1.145) applicable to local topographic and meteorological characteristics and to the type and mode of release appropriate to the plant. For environmental assessment purposes, nominal meteorological conditions are determined rather than the adverse conditions determined for safety assessments.

(2) Examine atmospheric transport and diffusion parameters for applicability to local topographic and meteorological characteristics by considering the experimental bases for these parameters with respect to the local conditions. The release point characteristics should be the same as those used for input to the individual dose assessments.

Regional and Local Air Quality Characteristics

When analyzing regional and local air quality characteristics, the reviewer should take the following steps:

(1) Assess the description of the existing regional air quality for completeness and accuracy.

(2) Identify the air pollutants for which there are non-attainment or maintenance areas in the region.

(3) Determine the emissions expected from plant construction or operation activities, as appropriate. Work force vehicular emissions should be estimated.

(4) Evaluate the impact of emissions from plant construction and operation on existing air quality. If the site is within or near a non-attainment or maintenance area, a conformity analysis may be required (see 40 CFR 51, Subpart W).

(5) Determine whether appropriate permits have been obtained.

Early Site Permit Reviews

When conducting a meteorological review of an early site permit (ESP) application, the reviewer should take the following steps:

(1) Refer to 10 CFR 52, which specifies the requirements and procedures applicable to the Commission's issuance of early site permits for approval of a site or sites for one or more nuclear power facilities separate from the filing of an application for a construction permit (CP) or combined license (COL).

(2) Note that application for an early site permit must include the

- number
- type and thermal power levels of the facilities for which the site may be used
- boundaries of the site
- proposed general location of each facility
- maximum radiological and thermal effluents that each facility will produce
- types of cooling systems that may be associated with each facility
- meteorological characteristics of the proposed site.

The scope and level of detail needed for meteorological review of an ESP application are the same as for review of a CP application under 10 CFR 51, except that the focus of the review is on the effects of construction and operation of a reactor, or reactors, which have characteristics that fall within the postulated site parameters.

IV. EVALUATION FINDINGS

The depth and extent of the input to the environmental impact statement (EIS) will be governed by the environmental characteristics of meteorology that could be affected by plant construction and operation, and by the nature and magnitude of expected impacts to the atmospheric environment. The following information should be included in the EIS:

- a description of the general climate of the region, including types of air masses, synoptic features, general airflow patterns, and climatological normals of parameters, such as temperature and precipitation

- a discussion of the severe weather phenomena (e.g., tornadoes, hurricanes, thunderstorms, atmospheric stagnation episodes) experienced in the region with expected frequencies of occurrence and measured extremes of parameters, such as temperature and precipitation

- a description of the local airflow patterns and characteristics, using data collected from the onsite meteorological measurements program

- a description of the atmospheric transport and diffusion characteristics in the region (out to a distance of 80 km [50 mi] from the site) and at the site and vicinity, which should include references to the diffusion models used and identification of the input data considered.

For reviews related for CP, operating license (OL), COL, and ESP applications, the reviewer should verify 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 onsite meteorological data presented by the applicant. Based on this review, the staff concludes that the meteorological data provide an adequate basis for estimating atmospheric transport and diffusion for this environmental statement.

If the meteorological data are not adequate, an alternative statement similar to the following should be included followed by a list of the adjustments made:

- The staff reviewed the onsite meteorological data presented by the applicant. Based on this review, the staff concludes that the meteorological data do not provide an adequate basis for estimating atmospheric transport and diffusion for this EIS. Therefore, the staff have applied the following conservatisms to relative concentration and relative deposition estimates: ...

For COL applications pursuant to 10 CFR 52 Subpart C that reference an ESP, the staff review focuses on whether the design of the facility falls within the parameters specified in the ESP and any other significant environmental issues not covered in any proceeding on the site or design. In this case, the staff should include statements of the following type:

- The staff reviewed the meteorological and climatological parameters specified in the early site permit and the facility design. The staff concludes that the facility design falls within the site parameters.

- The staff reviewed the climatological and meteorological characteristics of the site, the facility design, and previous proceeding related to the site and design. On the basis of these reviews, the staff concludes that all significant issues related to the atmosphere have been considered in previous proceedings.

If the staff are unable to reach these conclusions, statements of the following type should be included followed by descriptions of the exceptions and conclusions regarding the exceptions:

- The staff reviewed the meteorological and climatological parameters specified in the early site permit and the facility design. The staff concludes that the facility design falls within the site parameters except....

- The staff reviewed the climatological and meteorological characteristics of the site, the facility design, and previous proceeding related to the site and design. On the basis of these reviews, the staff concludes that all significant issues related to the atmosphere have been considered in previous proceedings except....

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

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

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

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

10 CFR 52.17, "Contents of application."

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

10 CFR 52.81, "Standards for review of applications."

10 CFR 100.10, "Factors to be considered when evaluating sites."

10 CFR 100.20, "Factors to be considered when evaluating sites."

40 CFR 50, "Primary and Secondary Ambient Air Quality Standards."

40 CFR 51, Subpart W, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans."

40 CFR 51, Appendix W, "Guidelines on Air Quality Models."

40 CFR 81, Subpart C, "Section 107 Attainment Status Designations."

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U.S. Nuclear Regulatory Commission (NRC). 1983. *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*. Regulatory Guide 1.145, Rev 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1987. *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

STANDARD FORMAT FOR HOURLY METEOROLOGICAL DATA

When hourly meteorological data are submitted to the NRC, the data may be submitted on mutually-agreed-upon media. The data should be in files that are of a size that are convenient for use and storage. Annual data files are acceptable.

Data processing by the NRC staff will be facilitated if the data files are written as formatted, sequential access ASCII files with one hour of data per record. Data within a record should be right justified. Extraneous characters should not be included in the data format. For example, the decimal point should not be written unless there are numerical values. Similarly, blanks may be used to indicate missing data, but zeros should not be used because they are interpreted as real data.

A note (ReadMe file) that describes the files should be included with each submission to NRC. This note should describe how the files were created (type of machine, operating system, and programming language), list the contents of each file, and contain a brief description of the meteorological data. The meteorological data description should include the heights of the wind sensors. The description may also include a discussion of data processing that occurred before the data files were created.

Use a standard record format for hourly meteorological data. The standard data format is similar to the format described in Appendix A of Standard Review Plan 2.3.3 (NRC 1987). The only differences are in the first two fields of the data records. The second field has been increased to permit specification of the year using four digits rather than two, and the first field has been reduced from six bytes to four bytes and is now specified as a character string rather than an integer. The format for the remainder of the record is identical to the format in SRP 2.3.3.

At the beginning of each file, use the first five records to give a data description. Include plant name, location (latitude, longitude), dates of data, information explaining data contained in the "other" fields if they are used, height of measurements, and any additional information pertinent to identification of the tape. Make sure all five records are included, even if some are blank. Format for the first five records will be 160A1. Meteorological data format is (A4, I4, I3, I4, 25F5.1, F5.2, 3F5.1). Table 2.7-1 shows the size and content of each field in the meteorological data records in the standard format. In addition, it provides a form for recording supporting information about the meteorological instrumentation.

All data should be given to the tenth of a unit, except solar radiation, which should be given to a hundredth of a unit. This does not necessarily indicate the accuracy of the data (e.g., wind direction is usually given to the nearest degree). All nines in any field indicate a lost record (99999). All sevens in a wind-direction field indicate calm (77777). If there are only two levels of data, use the upper and lower levels. If there is only one level, use the upper level.

Table 2.7-1. Hourly Meteorological Data

LOCATION:

DATE OF DATA RECORD:

A4	Identifier (can be anything)	
I4	Year	
I3	Julian Day	
I4	Hour (on 24-hour clock)	
		ACCURACY
F5.1	Upper Measurements: Level = _____ meters	_____
F5.1	Wind Direction (degrees)	_____
F5.1	Wind Speed (meter/sec)	_____
F5.1	Sigma Theta (degrees)	_____
F5.1	Ambient Temperature (°C)	_____
F5.1	Moisture: _____	_____
F5.1	Other: _____	_____
F5.1	Intermediate Measurements: Level = _____ meters	_____
F5.1	Wind Direction (degrees)	_____
F5.1	Wind Speed (meter/sec)	_____
F5.1	Sigma Theta (degrees)	_____
F5.1	Ambient Temperature (°C)	_____
F5.1	Moisture: _____	_____
F5.1	Other: _____	_____
F5.1	Lower Measurements: Level = _____ meters	_____
F5.1	Wind Direction (degrees)	_____
F5.1	Wind Speed (meter/sec)	_____
F5.1	Sigma Theta (degrees)	_____
F5.1	Ambient Temperature (°C)	_____
F5.1	Moisture: _____	_____
F5.1	Other: _____	_____

Table 2.7-1. (contd)

F5.1	Temp. Diff. (Upper-Lower) (°C/100 meters)	_____
F5.1	Temp. Diff. (Upper-Intermediate) (°C/100 meters)	_____
F5.1	Temp. Diff. (Intermediate-Lower) (°C/100 meters)	_____
F5.1	Precipitation (mm)	_____
F5.1	Solar Radiation (cal/cm^2/min)	_____
F5.1	Visibility (km)	_____
F5.1	Other: _____	_____
F5.1	Other: _____	_____

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

2.8 RELATED FEDERAL PROJECT ACTIVITIES

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) (1) directs the staff's identification, description, and environmental assessment of Federal activities that are related to the proposed project, and (2) identifies the possible need for another Federal agency to participate in the preparation of the environmental impact statement (EIS) as a cooperating agency.

The scope of the review directed by this plan will be limited to directly related Federal project activities that affect plant siting or transmission line routing, plant water supply, or the need for power. Actions related only to the granting of licenses, permits, or approvals by other Federal agencies should not be considered in this review because such activities typically have an independent environmental review. When relevant activities are identified, the results of this review will form the basis for an assessment of the interrelationship and cumulative environmental impacts of the proposed project and the related Federal activity and the potential need for another agency to participate in the EIS process as a cooperating agency.

Review Interfaces

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

- ESRPs 1.1 and 1.2. Provide information in the EIS that reflects possible cumulative impacts of related Federal projects.

- ESRP Chapters 4.0 and 5.0. Provide descriptive information in ESRP 2.8 in sufficient detail to support the impact assessments presented in ESRP Chapters 4.0 and 5.0. Determine which sections are appropriate on the basis of the identified Federal activities' actions that have significant project related impacts.

- ESRP Chapter 10.0. Provide the reviewers for ESRP Chapter 10.0 with information for their consideration regarding the impacts associated with the identified Federal activities.

The reviewer should also obtain information on cumulative environmental inputs of any related Federal projects. If there are related Federal projects, information from other ESRPs on the principal land-use, hydrology, water uses and quality, terrestrial and aquatic ecology, socioeconomics, geology, and meteorology features of the site and vicinity needs to be obtained in sufficient detail to allow for an evaluation of cumulative impacts resulting from related Federal projects.

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 will be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- a description of Federal actions associated with acquisition and/or use of the proposed site and transmission corridors or of any other offsite property needed for the proposed project (from the environmental report [ER])

- a description of planned Federal projects that will be required either to provide an adequate source of plant cooling water or to ensure an adequate supply of cooling water over the operating lifetime of the plant (from the ER and also consultations with Federal, State, local, and affected Native American tribal agencies)

- descriptions of any other planned Federal projects or activities that must be completed as a condition of plant construction or operation (from the ER and consultations with appropriate Federal agencies)

- Federal agency plans or commitments that will result in significant new power purchases within the applicant's service area that have been used to justify a need for power (from the ER and consultation with appropriate Federal agencies)

- descriptions of planned Federal projects that are contingent on plant construction and operation (from the ER and consultation with appropriate Federal agencies).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of information on related Federal-project activities and the possible need for one or more cooperating agencies in preparation of the EIS are based on the relevant requirements of the following:

- 40 CFR 1508.25 and 10 CFR 51.14(b) with respect to the scope of an EIS and consideration of the cumulative impacts of connected, cumulative, and similar actions

- 40 CFR 1501.6, 10 CFR 51.10(b)(2), and 10 CFR 51.14 with respect to the possible need for cooperating agencies in the preparation of the EIS

- 10 CFR 51.29(a)(7) with respect to the possible need to identify cooperating agencies.

Data provided by the applicant will generally be adequate if future actions of other Federal agencies that are connected with, cumulative with, or similar to the NRC action are identified and described in sufficient detail to enable an assessment to be made.

Technical Rationale

The technical rationale for identifying related Federal-project activities is discussed in the following paragraph:

> The bases for the need for the information called for in this ESRP are 40 CFR 1508.25 and 40 CFR 1501.6. The Council on Environmental Quality's (CEQ's) definition of the term "scope" at 40 CFR 1508.25 calls for Federal agencies to consider the cumulative impacts of related actions that are connected, cumulative, or similar when determining the appropriate scope for an EIS. The terms "connected," "cumulative," and "similar" are defined in 40 CFR 1508.25(a). NRC has indicated that it will follow CEQ's definition of scope (10 CFR 51.14[b]). In some cases, it may be necessary or desirable for another Federal agency to participate in preparation of the EIS when actions of the agency are related to those of NRC. The CEQ regulations provide (at 40 CFR 1501.6) for cooperating agencies in certain instances in the preparation of an EIS. NRC has indicated that it will follow (with certain exceptions) the provisions of 40 CFR 1501.6 (10 CFR 51.10[b][2]). NRC defines the term "cooperating agency" (in 10 CFR 51.14) as a Federal agency, other than the NRC, that has jurisdiction by law or special expertise for an environmental impact being considered by NRC in an environmental document for a proposed action that can significantly affect the quality of the human environment. The definition also provides that in appropriate cases, a State, local government entity, or Native American tribe may become a cooperating agency by agreement with the Commission. When reasonably significant impacts associated with actions of another agency are identified through the ER, the scoping process, or otherwise, and these impacts are significant enough to justify the participation of the agency(ies) in the NRC EIS process, NRC staff should identify such potential cooperating agency(ies) and determine appropriate writing assignments and schedules for preparation of the EIS (10 CFR 51.29[a][7]).

III. REVIEW PROCEDURES

When analyzing the related Federal-project activities, the reviewer should take the following steps:

(1) Identify the planned activities of other Federal agencies that are directly related to the proposed project (i.e., that either would not be undertaken or would be of lesser scope if the project had not been proposed or is not approved). As noted in Section I (Areas of Review), above, activities of other Federal agencies related only to the granting of licenses, permits, or approvals will not be considered in this review.

- When relevant Federal activities are identified, contact the EPA Office of Federal Activities for assistance and regional and local representatives of Federal agencies to obtain relevant information.

- When no such Federal activities can be identified, terminate the review and state in ESRP 2.8 that the review identified no related Federal activities.

(2) Determine the specific relationships of each identified activity with the proposed project by categorizing them as

- activities that are requisites to project construction (e.g., sale or transfer of Federal land)

- activities that justify some of the need for power (e.g., a planned Federal project that will depend on power to be supplied by the proposed project)

- a planned Federal project that will not or cannot be accomplished unless the plant is constructed.

(3) Determine the significance of any related Federal activity on the project by conducting a preliminary analysis of each identified Federal activity to determine in general terms the nature and extent of the environmental impacts that would be cumulative with those of the proposed project.

- When the reviewer determines that these impacts are minor, no further consideration of the activity is required.

- As a general rule, if the Federal agency responsible for the Federal activity has determined that preparation of an EIS is required, the staff may conclude that the impacts are of sufficient scope to merit further analysis of the activity to determine those impacts that would be cumulative with those of the proposed project.

(4) Consider whether the Federal agency should be a cooperating agency on the NRC EIS.

(5) If the environmental impacts of the related Federal activity could be significant, conduct a further analysis of each such activity to the extent necessary to identify those probable environmental impacts (and potential benefits) that could be expected as a result of construction and operation of the proposed project.

- Limit the impacts and benefits to be considered to those having a direct relationship with the proposed project and those that will add to or subtract from an impact or benefit (e.g., land use, transmission corridor clearing, and/or aquatic impacts) predicted for the proposed project.

- Consider only those activities associated with the primary functions of the related activity (e.g., construction and operation of a Federal facility) and, except for unusual circumstances, do not address secondary effects (such as induced industrial/community growth).

- Provide this information to the appropriate ESRP Chapter 4.0 and 5.0 reviewers for their consideration in determining the cumulative impacts of the proposed project and the related Federal activity.

(6) Ensure that

- relevant Federal activities have been identified

- their interrelationships with the proposed project have been described

- all activities having potentially significant environmental impacts have been described in sufficient detail to permit a subsequent environmental impact analysis to determine the cumulative effects of these impacts with those of the proposed project. In particular, take the following steps:

  - Based on an overview of the proposed project activities, consultations with local and regional representatives of Federal agencies, and any input supplied by cooperating agencies, determine if relevant Federal activities have been identified and whether their interrelationships with the proposed project have been described.

  - Based on your experience and on consultation with the appropriate ESRP Chapter 4.0 and 5.0 reviewers, determine which of the identified Federal activities will have environmental impacts that would be cumulative with impacts of the proposed project and that are of sufficient magnitude to be considered in subsequent ESRP Chapter 4.0 and 5.0 assessments of cumulative impacts.

  - Ensure that the Federal activities selected for consideration have been described in sufficient detail to permit an environmental impact assessment to be made.

- make a preliminary determination as to whether any other Federal agency (or in some cases a State, regional, local, or affected Native American tribal agencies) should be contacted about their interest in becoming a cooperating agency on the NRC EIS.

IV. EVALUATION FINDINGS

The depth and extent of the input to the EIS will be governed by the nature of the related Federal activities and the extent to which the significant impacts of these activities (both beneficial and adverse) are cumulative with impacts of the proposed project. The following information should be included in the EIS:

- a list of related Federal activities and their interrelationships with the proposed project, using the categories described in Section III(2) of this ESRP

- identification of the activities that have no significant impacts and the staff's basis for this conclusion

- for those activities having potentially significant environmental impacts that would be cumulative with those of the proposed project, a brief description of the overall activity and a sufficiently detailed description of those portions of the activity related to the proposed project as needed to provide the necessary background information to support the assessments of cumulative impacts in ESRP Chapters 4.0 and 5.0.

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 51.10, "Purpose and scope of subpart; application of regulations of Council on Environmental Quality."

10 CFR 51.14, "Definitions."

10 CFR 51.29, "Scoping—environmental impact statement."

40 CFR 1501.6, "NEPA and Agency Planning: Cooperating Agencies."

40 CFR 1508.25, "Terminology and Index: Scope."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.3 PLANT WATER USE

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 plant water use description portions of the environmental impact statement (EIS). The scope of the paragraph covered by this plan introduces the material to be presented from the reviews conducted under ESRPs 3.3.1 and 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 plant water use description 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 3.3.1 and 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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.3.1 WATER CONSUMPTION

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description of plant water use (e.g., circulating water system, sanitary waste system, radwaste and chemical waste systems, and service water systems).

The scope of the review directed by this plan includes descriptions of the quantity of water required for plant operation, the amount of water consumed by the plant water systems, and the amount of water discharged to a water body. Variations in water requirements and consumption on a temporal basis and as a function of plant operating modes should be included. Where water use for station operation is greater than plant water use, these uses should also be included. The review should be in sufficient detail to provide basic data for other reviews dealing with the evaluation of plant operational 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 3.3.2. Provide data on plant or station water requirements in sufficient detail to support the analysis in ESRP 3.3.2.

- ESRP 3.4.1. Obtain descriptions of the plant cooling system and operational modes.

- ESRPs 3.4.2, 3.5, 3.6, 4.2.1, and 4.2.2. Provide plant water use data.

- ESRPs 5.2.1, 5.2.2, 5.3, and 6.6. Provide plant or station water use data requirements in sufficient detail to support the assessments given in those sections.

- ESRP 9.4.1. Provide plant water consumption data as needed for analyses and evaluations of plant or component alternatives.

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 should be in sufficient detail to trace the flow of water from the water supply sources to the points of discharge, indicating quantities consumed at each point of consumption as a function of plant operating conditions. The following data and information should be obtained:

- a narrative description of the various plant water systems, their interconnections, and their operational interdependence and coordination (from the environmental report [ER])

- a water-use diagram for the plant (Rosaler 1994) showing flow rates to and from the various water systems (e.g., circulating water system, sanitary system, radwaste and chemical waste systems, service water systems), points of consumption, and source and discharge locations (from the ER)

- for the water-use diagram required (above), the data and narrative description for maximum water consumption, water consumption during periods of minimum water availability, and average operation by month and by plant operating status (from the ER)

- a description of other station water uses (i.e., all facilities not associated with the proposed plant) showing flow rates to and from the facility, average water consumption, and maximum water consumption (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of proposed plant water use 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

- 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 States were granted additional authority to limit hydrological alterations beyond the State's role in regulating water rights.

- Regulatory Guide 4.2, *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 description of plant water use is discussed in the following paragraph:

A detailed and thorough description of the plant water consumption is essential for the evaluation of potential impacts to the environment that may result from plant, construction, or operation.

III. REVIEW PROCEDURES

ESRP 3.3.1 is intended to give a brief description of the water use in plant systems and the principal subsystems. The reviewer's analysis should be closely linked with the reviews listed in the Review

Interfaces section of this ESRP to establish the plant water-use characteristics of concern to those reviews. Details of the principal subsystems are described in ESRPs 3.4.2, 3.5, and 3.6. Therefore, the reviewer of ESRP 3.3.1 should concentrate on the description of principal flow paths from the sources of water through each subsystem to the receiving water bodies without detailed flow patterns within each subsystem. With this in mind, the reviewer should take the following steps:

- Analyze the flow diagrams of plant water systems by performing simple mass balance computations to ascertain whether the reported flow rates (water source withdrawals, different plant water system needs, and discharge flows) are consistent for each plant operating mode.

- Consider periods of maximum water consumption, minimum water availability, and average operation by month.

- Determine if there are other station facilities with water uses not associated with operation of the proposed plant and include these uses in the analysis.

IV. EVALUATION FINDINGS

The following information from this ESRP should be included in the EIS:

- a description of the flow path of water from the water sources through each major plant water system (e.g., heat-dissipation system, sanitary system, radwaste and chemical waste systems, service water systems) to the points of discharge, including consumption for each such path (e.g., cooling tower evaporation)

- a flow diagram to assist in tracing the flow path and the rates of flow for maximum water consumption, water consumption during periods of minimum water availability, and average operation by month. Details of seasonal and other operating variations may be provided in narrative and tabular forms.

- as appropriate, descriptions of other station water requirements.

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.”

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).

Rosaler, R. (ed.) 1994. *Standard Handbook of Plant Engineering*, Second Edition, McGraw-Hill, New York.

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

3.3.2 WATER TREATMENT

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 treatment needed for the plant water streams identified in ESRP 3.3.1 using the water supplies described in ESRPs 2.3.1 and 2.3.3. The scope of the review directed by this plan includes a description of water treatment processes for potable, cooling and recirculating systems and identification and quantification of the chemicals used. The descriptions to be provided by this review should be of sufficient detail to permit subsequent assessment and evaluation of specific impacts of plant water treatment and provide a basis for ESRP 3.6.

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 2.3.3. Obtain descriptions of the hydrology and the water quality of the water supplies to the plant.

- ESRP 3.3.1. Obtain descriptions of the water consumption in the plant water streams.

- ESRPs 3.6.1 and 3.6.2. Provide details of water treatment systems and treatment processes to support the descriptions of nonradioactive waste systems.

- ESRPs 4.2.2 and 5.2.2. Provide descriptions of water treatment systems and processes to be used to assess water-use impacts of construction and operation.

- ESRP 5.3.2.1. Obtain the descriptions of the cooling system discharge process.

- ESRP 9.4.2. Provide descriptions of water treatment systems that may be used in any comparison or evaluation of alternative water-treatment 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:

- a description and purpose of water treatment systems used in the plant (from the environmental report [ER])

- identification, quantities, and points of addition of chemicals and additives to be used by each system (from the ER)

- operating cycles for each water treatment system for normal modes of plant operation (e.g., full power operation, shutdown/refueling, and startup) (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of water treatment processes are based on the relevant requirements of the following:

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

- 40 CFR 165 with respect to chemicals and biocides used for treating water

- 40 CFR 403 with respect to effluent limitations

- 40 CFR 423 with respect to effluent limitations on existing and new point sources

- State and Native American tribal water laws and water rights

- WASH 1355, *Nuclear Power Facility Performance Criteria for Making Environmental Impact Assessments* (NRC 1974).

- Safe Drinking Water Act

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.

- 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 States were granted 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 water treatment description is discussed in the following paragraph:

A detailed and thorough description of the plant water treatment system 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 analysis of water treatment should be closely linked with the impact assessment review of ESRPs 4.2 and 5.2 to establish which water-treatment systems and processes have a potential for environmental impact. With this in mind, the reviewer should take the following steps when analyzing the proposed water treatment systems, to the extent needed to prepare a description of the purpose and nature of each system:

Note: The principal types of treatment systems that should be described include those necessary to condition (1) the intake water for noncooling-system use within the plant and (2) water used in the plant cooling system and treatment systems required for providing potable water. Chemicals used in these systems should be described.

(1) Include a brief description of treatment system operating procedures, including plant operational and seasonal variations (AWWA 1990).

(2) Further define each treatment system in terms of the purpose of the proposed processes and the chemicals required.

(3) Identify the proposed use of chemicals. Only the systems that result in a waste discharge need to be analyzed in detail, and the reviewer should emphasize the systems that have a potential for requiring an NPDES permit.

(4) Verify that

- All water streams identified in ESRP 3.3.1 have been considered.
- All chemicals (identification and quantities) to be used have been considered or described.
- The status of NPDES permits and consultations with NPDES administrative agencies have been discussed.
- The proposed systems have been described in sufficient detail to permit assessment of environmental impacts resulting from their operation.

(5) Ensure that the water treatment information is adequate to serve as a basis for assessing the impacts of station construction and operation on water use.

IV. EVALUATION FINDINGS

As input to the EIS, the reviewer should provide a concise description of the proposed water treatment systems that results in waste discharge and include a tabulation of chemicals to be added by quantity and frequency of addition. Proposed systems that do not result in waste discharges should be identified, but not described in detail. Unresolved differences between the staff's analysis and the applicant's proposed operation of any water-treatment systems should be noted.

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

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

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 403, “General Pretreatment Regulations for Existing and New Sources of Pollution.”

40 CFR 423, “Stream Electric Power Generating Point Source Category.”

American Water Works Association (AWWA). 1990. *Water Quality and Treatment*, 4th Edition, McGraw-Hill Book Company, New York.

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).

Safe Drinking Water Act Amendments of 1996. PL 104-182.

U.S. Nuclear Regulatory Commission (NRC). 1974. WASH 1355, *Nuclear Power Facility Performance Criteria for Making Environmental Impact Assessments*, 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

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.4 COOLING 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 cooling system description portions of the environmental impact statement (EIS). The scope of the paragraph covered by this plan is to introduce the material to be presented from the reviews conducted under ESRPs 3.4.1 and 3.4.2.

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 cooling system description 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 3.4.1 and 3.4.2. 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

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.4.1 DESCRIPTION AND OPERATIONAL MODES

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 description of the proposed plant cooling system and its operational modes. The scope of the review directed by this plan should include a general description of the proposed cooling system and a more detailed identification and description of the anticipated modes of operation of the cooling system.

The description to be provided by this review should be in sufficient detail to permit subsequent staff assessment and evaluation of specific impacts of the cooling system as a function of primary and alternative cooling system operational modes.

Reviewer 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 the status of the National Pollutant Discharge Elimination System (NPDES) permit.

- ESRP 2.3.3. Obtain baseline water temperature information, including monthly variation and stratification for the body of water used for cooling intake and discharge.

- ESRP 2.7. Provide descriptions of the cooling system and relevant components for use in determining potential impacts of heat dissipation.

- ESRP 3.3.1. Provide descriptions of the plant cooling system and operational modes.

- ESRP 3.4.2. Provide the characteristics of the various operational modes of the cooling system in sufficient detail to support the cooling system component description.

- ESRP 3.6.1. Obtain information on biocides or other chemicals anticipated to be used to control organisms in the cooling system.

- ESRP 4.2.2. Provide information regarding projected water needs of the cooling system.

- ESRP 5.1.1. Provide information specific to operational aspects of cooling system siting.

- ESRPs 5.2.1 and 5.2.2. Provide cooling system characteristics in sufficient detail to support the assessment of impacts to water use.

- ESRP 5.3.1.1, 5.3.1.2, and 5.3.2.1. Provide descriptions of the cooling system.

- ESRP 5.3.4. Provide a description of the cooling system and its operational modes and components, including estimated noise levels.

- ESRP 6.1. Provide thermal aspects of the cooling system of the proposed plant.

- ESRPs 6.5.1 and 6.5.2. Provide a description of the cooling system and its operation modes to support evaluation of 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:

- a system description (from the environmental report [ER])

- descriptions of anticipated operational modes and the estimated periods of time that the system will operate in each mode (from the ER)

- for each anticipated operational mode, quantities of heat generated, dissipated to the atmosphere, and released in liquid discharges (from the ER)

- for each operational mode, water source and quantities of water withdrawn, consumed, and discharged (from the ER)

- the status of the NPDES permit and any 316(a/b) demonstrations (from ESRP 1.2).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the cooling system for potential environmental impacts are based on the relevant requirements of the following:

- 10 CFR 52.17 (a)(1)(v) with respect to early site permits related to the type of cooling systems, intakes, and outflows that may be associated with the facility

- 10 CFR 50.34 with respect to a description and analysis of the structure, systems, and components of the facility.

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), addresses the inclusion of information about the reactor and power conversion system.

Technical Rationale

The technical rationale for evaluating the applicant's description of the proposed cooling system and its operational modes is discussed in the following paragraph:

> The cooling system presents a major source of interaction with the environment and of possible impacts. The environmental impacts caused as a result of operation of the cooling system at a nuclear power plant depend largely on the type of cooling system and system alternatives, if such exist, to accommodate load changes or adverse conditions. A thorough description of the system and the proposed operational modes allows an objective examination of the potential impacts to the environment. This section is descriptive in nature. The description of the external appearance of the cooling system and its operational modes should be in sufficient detail to form an adequate base for staff analysis of the potential impacts of construction or operation.

III. REVIEW PROCEDURES

For the review of the cooling system description and operational modes, the reviewer should take the following steps:

(1) Ensure that sufficient information on plant operational modes is available to define cooling system performance for each identified mode of operation.

(2) Verify that plant water consumption and flow-rate data are consistent with the water-use analysis prepared by the reviewer for ESRP 3.3.1.

(3) Analyze the overall cooling-system design for the following:

- compatibility with the water-use descriptions of ESRP 3.3.1
- consistency with good engineering design

(4) Identify and describe nonemergency modes of operation, including the following (as applicable):

- design normal, with estimated monthly maximum, average, and minimum values of the operating parameters
- heat treatment (thermal bio-control)
- de-icing
- reduced intake flow (pump outage)

(5) Consider the following operating parameters for each mode of operation:

- intake flow rates
- discharge flow rates
- circulating water (condenser) flow rates
- other major plant system flow rates
- temperature rise across the condenser
- temperature rise across heat exchangers in the service water systems
- heat dissipation system discharge temperatures
- chemical concentration factors for major cooling system components
- frequency and duration of operation for each mode.

IV. EVALUATION FINDINGS

The depth and extent of the input to the environmental impact statement (EIS) will be governed by the characteristics of the cooling system and plant primary and alternative operational modes and by the nature and magnitude of the expected impacts. The following information should be included in the EIS:

- narrative description of the cooling system

- description of anticipated operational modes. For each mode, provide the important characteristics analyzed (e.g., frequency and duration, discharge temperature, water consumption, and chemical concentration factor).

- cooling system status with respect to Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act, certification and NPDES permits.

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."

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

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

3.4.2 COMPONENT DESCRIPTIONS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's preparation of descriptions of the proposed intake, discharge, and heat dissipation system design and performance characteristics. The scope of the review directed by this plan should include (1) intake, discharge, and heat dissipation system design data and (2) performance characteristics of these systems for the operational modes identified by the reviewer for ESRP 3.4.1.

This review should provide input to other reviews dealing with analysis and assessment of construction and operational impacts of cooling system components and to other sections that deal with design and operational alternatives and benefit-cost analysis.

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 a description of aquifers, rivers, cooling lakes or ponds, and site-specific water supply data.

- ESRP 2.7. Obtain site-specific meteorological data and provide a description of the cooling system.

- ESRP 3.2. Obtain the reactor and plant system description and performance parameters as they pertain to the cooling system.

- ESRP 3.3.1. Obtain the projected water consumption of the cooling system.

- ESRP 3.4.1. Obtain a description of the heat dissipation system operational modes.

- ESRPs 4.1.1, 4.2.2, and 4.3.2. Provide the reviewers for cooling system design data to permit analysis and assessment of cooling system construction impacts.

- ESRPs 5.2, 5.3.3.2, and 5.8.1. Provide design and operating characteristics of the cooling system components for predicting and assessing environmental impacts of the proposed cooling system.

- ESRP 5.2.2, 5.3.1.1, and 5.3.2.1. Provide a description of the intake and discharge parameters of the cooling system.

- ESRP 5.3.4. Provide information on the cooling system components and operational modes, including the estimated noise levels.

- ESRPs 6.1 and 6.3. Provide a description of the cooling system of the proposed plant.

- ESRPs 9.4.1 and 9.4.2. Provide descriptive detail to serve as the basis for a comparison of alternative intake, discharge, and heat dissipation systems.

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:

- For intake systems, include

    - a drawing of the intake structure showing the relationship of the structure to the water surface, bottom geometry, and shoreline (from the environmental report [ER])

    - a description of the cooling water pumping facility (from the ER)

    - a description of the trash racks, traveling screens, trash baskets, and fish return devices (from the ER)

    - performance characteristics (e.g., flow rates, intake velocities) for the operational modes identified by the reviewer for ESRP 3.4.1 (from the ER)

- performance characteristics for specific intake-related functions, such as de-icing, trash rack clearing, screen washing, trash basket removal, or fish return system operation (from the ER)

- the location and description of components for the addition of chemicals (e.g., corrosion inhibitors, antifouling agents) to the intake system (from the ER).

- For discharge systems, include

  - drawings of the outfall structure, showing its location in the receiving water body, relationship to water surface, bottom geometry, and shoreline (from the ER)

  - a description of discharge canal or discharge lines (from the ER)

  - performance characteristics (e.g., discharge flow rates, discharge velocities, discharge temperatures, and temperature differentials) for the operational modes identified by the reviewer for ESRP 3.4.1 (from the ER)

  - descriptions of specific discharge related components (e.g., diffusers, fish barriers) (from the ER).

- For heat-dissipation systems, include

  - the location of heat dissipation system components relative to other site features (from the ER)

  - the design details of heat dissipation system components affecting system performance, including those listed in Table 3.4.2-1

Table 3.4.2-1. Design Details of Heat Dissipation System Components

Component	Design Details
Cooling towers (from the ER)	Type Configuration Materials of construction Number and arrangement Rated heat-dissipation capacity
Cooling lakes and ponds (from ESRP 2.3.1)	Surface area Volume Bathymetry
Spray ponds or canals (from the ER)	Arrangement and configuration of spray modules Pond or canal geometry Surface area and water volume

Condenser (once-through systems)	Heat transfer area and materials of construction (from ESRP 3.2) Antifouling treatment (from the ER)

- heat dissipation system performance characteristics for the operational modes identified by the reviewer for ESRP 3.4.1, including those listed in Table 3.4.2-2

- site-specific meteorological data (from ESRP 2.7)

- site-specific water supply data (from ESRP 2.3.1)

- heat dissipation system performance analyses based on the manufacturer's design data and site-specific meteorological and hydrological data (from the ER).

Table 3.4.2-2. Performance Characteristics of the Heat-Dissipation System

Component	Design Details
Cooling towers (from the ER)	Input and discharge flow rates and temperatures for monthly average meteorological conditions Wet-bulb temperature, approach to wet-bulb, and range Performance curves (estimates if final design is not established) Air flow Power consumption Estimated noise levels Drift rate and drop size
Cooling lakes and ponds (from the ER)	Flow rates (through condenser) Flow-through times Flow pattern Monthly average water temperatures (mean for entire lake or pond, inlet [from condenser], outlet [to condenser]) Surface elevation (means, maximum, minimum)
Spray ponds or canals (from the ER)	Flow rates (through condenser) Flow-through times Flow pattern Monthly average water temperatures (inlet [from condenser], outlet [to condenser]) Surface elevation (mean, maximum, minimum) Spray-system operating parameters (e.g., power consumption, drop size)
Condenser (once-through systems) (from the ER)	Condenser flow rate Temperature differential across condenser Time-of-passage through system (including intake and discharge system passage times) Dissolution rate of metals in condenser tubes Frequency and magnitude of antifouling treatment

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the cooling system components are based on the relevant requirements of the following:

- 10 CFR 50.34 with respect to the need for a description of the components of the facility.

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 Station* (NRC 1976), with respect to providing a description of the applicant's planned cooling system components.

Technical Rationale

The technical rationale for evaluating the applicant's description of the components of the proposed cooling system is discussed in the following paragraph:

Detailed drawings and descriptions of the characteristics of the cooling system should be available for analysis to review the applicant's cooling system component design and performance characteristics so that the environmental assessment of construction and operation may be evaluated.

III. REVIEW PROCEDURES

The reviewer's analysis of the intake, discharge, and heat dissipation system component descriptions should be closely linked with the assessment of construction and operational impacts directed by ESRP Chapters 4.0 and 5.0. The intent of this analysis is to identify and describe the design and performance characteristics of the proposed cooling components that can be expected to cause environmental impacts as a result of construction or operation. The characteristics generally considered are listed under "Data and Information Needs" in this ESRP. Each cooling system component should be analyzed, and the reviewer should prepare descriptions of the design and performance characteristics that are generally expected to result in environmental impacts (e.g., intake configuration, flow velocity through traveling screens, cooling tower drift). The review should be based on the cooling system components described in the applicant's ER and should consider component performance for the operational modes described by the reviewer for ESRP 3.4.1. With this in mind, the reviewer should take the following steps:

(1) For all systems, evaluate intake and discharge temperatures and the temperature rise across the condenser.

(2) For cooling towers, determine average discharge temperatures for each month of the year using cooling tower performance curves. The average discharge temperature will be calculated by using the average wet-bulb temperature for the month.

(3) For spray systems, analyze the applicant's estimates of average monthly discharge temperatures. The depth and extent of this analysis should depend on the seriousness of the predicted impacts of the heated effluent on the receiving body of water and the level of confidence in the applicant's model.

(4) In the cases where auxiliary systems are employed to further cool the blowdown discharged from the main cooling system, determine the final discharge temperature.

(5) Consult with the appropriate ESRP Chapters 4.0 and 5.0 reviewers to determine additional cooling system component design or performance characteristics to be analyzed and described.

(6) Compare the cooling system descriptions with those of similar operating plants and identify design or operating features of the proposed cooling system that represent a major departure from previously reviewed systems.

(7) Determine if the cooling system component descriptions are consistent, accurate, and given in sufficient detail to serve the needs of the reviews of intake, discharge, and heat dissipation system impacts.

(8) Ensure that

- Descriptions of the intake, heat dissipation, and discharge systems are sufficiently complete to serve the purposes of the evaluations described by the appropriate ESRP Chapters 4.0 and 5.0, including any special descriptive information needed to evaluate compliance with applicable regulations (e.g., noise, Federal Water Pollution Control Act [FWPCA], commonly Clean Water Act).

- The predicted operational characteristics (e.g., flow rates and velocities) are consistent with system design.

- The proposed systems are consistent with good engineering practice.

- Unusual system designs are identified.

(9) Verify all significant performance characteristics and, if necessary, conduct independent analyses to ensure that performance characteristics are accurately described. The following are examples of such analyses:

- intake system flow rates, flow velocities, and velocity distributions

- cooling tower performance (e.g., approach to wet-bulb temperature, drift rate and droplet size, noise-level contours)

- cooling pond performance (e.g., capacity, mean temperature)

- spray system performance
- discharge system performance (e.g., flow velocity).

IV. EVALUATION FINDINGS

The depth and extent of the input to the environmental impact statement (EIS) will be governed by the characteristics of the intake, discharge, and heat dissipation systems, and by the nature and magnitude of the expected impacts in the site vicinity. The following information should be included in the EIS:

- narrative description of the intake, discharge, and heat dissipation systems
- sketches of intake, discharge, and heat dissipation components
- detailed drawings of important subsystems (e.g., perforated pipe assemblies)
- tables and graphs of important performance characteristics of the intake, discharge, and heat-dissipation systems when these parameters will be used (and referenced) by the appropriate ESRP Chapter 5.0 reviewers.

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."

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

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

4.2 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 and water-use impacts from construction. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 4.2.1 and 4.2.2.

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 potential 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 4.2.1 and 4.2.2 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

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

4.2.1 HYDROLOGIC ALTERATIONS

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 proposed project construction and construction activities.

The scope of the review directed by this plan should include (1) identification and description of proposed construction activities, including site preparation, plant construction, transmission corridor clearing and transmission line construction, and offsite construction that could result in hydrologic alterations, (2) description and analysis of the resulting hydrologic alterations and the physical effects of these alterations on other water users, (3) analysis of proposed practices to minimize hydrologic alterations having adverse impacts, and (4) analysis of compliance with applicable Federal, State, regional, local, and affected Native American tribal standards and regulations.

Review Interfaces

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

- ESRP 2.1. Obtain a description of the location of the proposed construction site and surrounding region.

- 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 (and users) for the area surrounding the proposed plant site.

- ESRP 2.8. Obtain input regarding any related Federal project activities that would affect or would be affected by the proposed plant construction.

- ESRP 3.1. Obtain descriptions of the external appearance of the proposed plant and the plant layout.

- ESRP 3.3. Obtain input regarding expected water use by the proposed plant.

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

- ESRP 3.7. Obtain input regarding power transmission systems for the proposed plant (including transmission-corridor clearing and transmission-line construction activities).

- ESRP 4.1.1. Provide a description of any construction activities located on a floodplain or wetland.

- ESRP 4.2.2. Provide a list of construction activities resulting in hydrologic alterations and their effects on other water users, and additional information to other ESRP Chapter 4.0 reviewers when the reviewer for ESRP 4.2.2 requests that such inputs be made.

- ESRPs 4.3.1 and 4.3.2. Provide a list of hydrologic alterations that will affect terrestrial or aquatic ecosystems.

- ESRP 4.6. Provide a list of applicant commitments and staff recommendations of practices to minimize hydrologic alterations.

- ESRPs 6.1 and 6.3. Provide a list of possible thermal and hydrologic alterations during construction that may require a monitoring program to obtain a National Pollutant Discharge Elimination System (NPDES) permit.

- Section 9.4.1. Provide assistance in identifying and evaluating alternative plant design and construction practices that would minimize or avoid hydrologic alterations that result in adverse environmental 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 and information should be obtained:

- descriptions of the physical characteristics of the surface-water bodies and groundwater aquifers (from ESRP 2.3.1)
- identification and description of project related construction activities expected to result in hydrologic alterations at the site, transmission corridors, and offsite areas. Activities include construction of cofferdams and storm sewers; dredging operations; placement of fill material into the water; creation of shoreside facilities involving bulkheads, piers, jetties, basins, or other structures or activities with potential to alter existing shoreline processes; construction of intake and outfall structures; water channel modifications; construction of roads and bridges; operations affecting water levels (flooding); dewatering activities; and construction activities contributing to sediment runoff, e.g., road construction, clearing and grading, fill or spoil placement (from the environmental report [ER], the site visit, and consultation with Federal, State, regional, local, and affected Native American tribal agencies).

- identification of water sources used during construction and the average and maximum use rates of these waters (from the ER)

- identification of water bodies receiving construction effluents and the expected average and maximum flow rates and physical characteristics (temperature, sediment load, velocities) of these effluents (from the ER)

- identification of hydrologic alterations expected to result from the project related construction activities listed previously. Examples include changes in water drainage characteristics, the flood-handling capability of the floodplains flow and circulation patterns, subsidence resulting from groundwater withdrawal, and erosion and sediment transport (from the ER).

- identification and location of groundwater and surface-water users and areas that could be affected by project related hydrologic alterations (from ESRP 2.3.2, the ER, and the site visit)

- descriptions of proposed practices and measures to limit or minimize expected hydrologic alterations (from the ER)

- Federal, State, regional, local, and affected Native American tribal agencies' best management practices and regulations (from consultation with above agencies)

- descriptions of proposed means to ensure construction activity compliance with applicable hydrological standards and regulations (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the hydrological alterations 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

- 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 227 with respect to criteria for evaluating environmental impacts

- 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 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 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 including hydrology, water-use, and water-quality issues.

Technical Rationale

The technical rationale for evaluating the applicant's proposed hydrologic alterations is discussed in the following paragraphs:

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

III. REVIEW PROCEDURES

The reviewer should ensure that the construction activities that result in hydrologic alterations have been identified and seek confirmation that the alterations that result in environmental impacts have been described in sufficient detail to allow for the subsequent analysis and assessment of these impacts. The reviewer should take the following steps:

(1) Identify alterations in water quantity in the various construction affected hydrologic systems under the existing and known future water rights and allocations.

(2) Describe the physical effects of identified alterations in the quantity of water available on other consumptive water users.

(3) Describe the physical effects of altered hydrologic geometry, flow and circulation patterns, and mixing processes on nonconsumptive water users and to terrestrial and aquatic ecology.

(a) Cooperate with the reviewers for ESRPs 4.1.1, 4.2.2, 4.3.1, and 4.3.2 in (1) determining the extent and magnitude of the resulting impacts and (2) evaluating means to mitigate or avoid these impacts.

(b) When project construction or construction activity within a floodplain or wetland has been proposed, evaluate the extent of compliance with applicable floodplain or wetland protection standards and give particular attention to the consideration of alternatives to avoid adverse effects.

(c) Assist the reviewer for ESRP 4.2.2 in evaluating the impacts of any construction or construction-related activity located in the floodplain or wetland.

(d) Assist the appropriate ESRP 9.4 reviewers in the identification and analysis of alternatives that would avoid construction or construction activity in the floodplain or wetlands.

(4) Describe the physical effects of altered erosional, depositional, and sediment characteristics on other water users, on nearby property, and to aquatic ecology.

The reviewer should identify the alterations by associating the previously identified activities with changes in (1) water quantity and availability, (2) hydrological geometries (especially within the floodplain or wetland), flow and circulation patterns, and mixing processes, and (3) erosion, deposition, and sediment transport. The reviewer should take the following steps:

(1) Analyze the water quantity and availability by analyzing the construction activities that can alter the quantities of water physically available in nearby hydrologic systems and determine the alterations.

(a) Consider all water used during construction:

- the sources of the water
- points of discharge
- all water diversions that change the quantities of water in various parts of water systems (e.g., construction dewatering).

(b) For the hydrologic systems where alterations in water quantities due to construction have been identified, determine the physical effects (e.g., altered well yields, water levels relative to intake pipes) likely to have impacts on other water users.

(2) Analyze the hydrologic geometry, flow and circulation patterns, and mixing processes by evaluating the construction activities that can alter hydrologic geometries, flow and circulation patterns, and mixing processes, and determining the alterations.

(a) Consider all construction activities within water bodies and diversions of water during construction.

(b) Give particular attention to construction and related activities located in the floodplains or wetlands.

(c) Identify any Federal, State, regional, local, or Native American tribal floodplain or wetland protection standards and analyze proposed project construction and construction-related activities with respect to these standards.

(3) Analyze the erosion, deposition, and sediment transport by evaluating the construction activities that can alter erosional, depositional, and sediment transport characteristics and determine the alterations.

(a) Consider all construction activities within water bodies in relation to the natural processes occurring before construction.

(b) For those areas where alterations in the natural erosional, depositional, and sediment transport processes have been identified, determine the physical effects (e.g., beach erosion, channel shoaling) likely to have impacts on other water users.

(4) Be familiar with the provisions of standards, guides, and agreements pertinent to the hydrological aspects of plant construction.

(a) Determine compliance and the adequacy of commitments to comply with applicable regulations and guides.

(b) Consult with appropriate Federal, State, regional, local, and affected Native American tribal agencies to make this determination.

IV. EVALUATION FINDINGS

Input from the review of this ESRP to the environmental impact statement (EIS) should be directed toward accomplishing the following objectives: (1) public disclosure of hydrologic alterations resulting from the proposed project construction or refurbishment activities and (2) presentation of the basis for the staff's analysis of the effects of these alterations.

The following information should be included in the EIS:

- a description of plant design and construction activities that will result in hydrologic alterations, and a description of these alterations and their effects for each affected water body
- quantities of water diverted or used at the construction site, effluent discharge quantities and physical characteristics, and any resultant hydrologic alterations during various stages of construction, including under storm flow conditions
- magnitudes and time variations of hydrological alterations and a comparison with the natural time variations of the hydrological parameters
- compatibility of proposed construction activities with hydrological provisions of Federal, State, regional, local, or affected Native American tribal regulations and requirements, e.g., commitments to compliance with shoreline management regulations
- the compatibility of proposed construction water diversions with existing and known water rights and allocations
- construction practices and procedures to minimize hydrological alterations or for alternative project designs or construction practices that might avoid them.

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

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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ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

4.2.2 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 description, analysis, and assessment of proposed project construction activity impacts on water use.

The scope of the review directed by this plan should include (1) identification of the proposed construction activities or hydrologic alterations resulting from proposed construction activities that could have impacts on water use, (2) identification of changes in water quality resulting from hydrologic alterations or from construction activity effluents, (3) analysis and evaluation of impacts resulting from these alterations and activities, (4) analysis and evaluation of proposed practices to minimize adverse construction impacts on water use, and (5) evaluation of compliance with Federal, State, regional, local, and affected Native American tribal regulations applicable to water use and water quality. The review should include analysis and evaluation of impacts to water quality, water availability, and water use.

Review Interfaces

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

- ESRP 2.1. Obtain a description of the location of the proposed construction site and the surrounding region.

- ESRPs 2.2.1 through 2.2.3. Obtain descriptions of the regional land uses for the area surrounding the proposed plant site.

- 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 (and users) for the area surrounding the proposed plant site.

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

- ESRP 2.8. Obtain input regarding any related Federal project activities that would affect or be affected by the proposed plant construction.

- ESRP 3.1. Obtain descriptions of the external appearance of the proposed plant and the plant layout.

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

- ESRP 3.6.2. Obtain input regarding water use for sanitary system during construction.

- ESRP 3.7. Obtain input regarding power transmission systems for the proposed plant.

- ESRPs 4.1.1 through 4.1.3. Provide a list of construction activities (e.g., groundwater depletion) that may have land-use impacts and, when applicable, a description of altered flood patterns resulting from construction or construction activities in the floodplain.

- ESRPs 4.2.1 and 5.2.2. Obtain input regarding hydrological alterations that are expected to result from the construction water-use changes from operation of the proposed plant.

- ESRPs 4.3.1 and 4.3.2. Provide a list of construction activities (e.g., surface runoff and water-quality degradation) that may have adverse terrestrial and aquatic ecology impacts.

- ESRPs 4.4.1 through 4.4.3. Provide a list of construction activities that may have socioeconomic impacts.

- ESRP 4.6. Provide a list of applicant commitments and staff evaluations of practices to limit adverse water-use impacts.

- ESRP 6.3 and 6.6. Provide a list of possible impacts potentially requiring monitoring.

- ESRPs 9.4.1 and 9.4.2. Provide a list of adverse environmental impacts affecting water use that could be mitigated or avoided through alternative project designs or construction practices, and assist in determining appropriate alternatives.

• ESRP 10.1. Provide a list of the unavoidable water-use impacts that are predicted to occur during or as a result of project construction.

• ESRP 10.2. Provide a brief summary of the irreversible and irretrievable commitments of water resources that are predicted to occur during or as a result of project construction.

• Interface with Environmental Project Manager (EPM). Obtain input from the EPM to verify that proposed modifications to water use plans are practical and should lead to an improvement in the benefit-cost balance.

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:

- descriptions of the site and vicinity water bodies and aquifers (including sole-source aquifers)
- descriptions of hydrologic alterations and their related construction activities
- the physical effects of hydrologic alterations
- comparisons of water quantity available to other water users with existing and known future water rights and allocations
- identification of water bodies receiving construction effluents (e.g., sanitary wastes, cleaning wastes, dust control, fuels and lubricants, chemical, herbicides, pesticides) and the expected average and maximum flow rates and composition of these effluents
- baseline water-quality data for surface-water and groundwater sources used during construction and impacted by construction activities
- potential changes to surface-water and groundwater quality (e.g., heavy metal contamination) resulting from substrate exposure during construction
- identification and locations of groundwater and surface-water users and areas that could be impacted by project related construction activities affecting water use (from ESRP 2.3.2, the site visit, and the environmental report [ER])
- predicted impacts on the water users identified in the previous item (from the ER)
- descriptions of any proposed practices and measures to control construction related water-use impacts. Factors to be considered include flooding, drainage, groundwater elevation, erosion,

sedimentation, water quality, protection of natural drainage channels and water bodies, protection of shorelines and beaches, restrictions on access to and use of surface water, protection against saltwater intrusion, and handling of fuels, lubricants, oily wastes, chemical wastes, sanitary wastes, herbicides, and pesticides (from the ER).

- consultations with Federal, State, regional, local, and affected Native American tribal regulators (from consultation with the above agencies)

- descriptions of proposed means to ensure construction activity compliance with water-quality and water-use standards and regulations

- water-quality requirements for key elements of aquatic ecosystem and domestic users.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the water-use impact 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

- 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

- 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 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.

Technical Rationale

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

A detailed and thorough description of the water use during construction activities is essential for the evaluation of potential impacts to the environment that may result from plant construction or operation. Water quality and water supply are linked. The authority to regulate water quality can be extended to regulate water supply if the domestic or environmental water needs are impacted by reduced water quality.

Where an assessment of the environmental impacts resulting from construction activities is available from a separate permitting authority (such as Corps, State, EPA, or NPDES permitting agency), NRC will consider the assessment in its determination of the magnitude of environmental impacts for striking an overall benefit-cost balance. Documentation of adequate consultation with the appropriate permitting authorities is required.

III. REVIEW PROCEDURES

The reviewer should take the following steps:

(1) Evaluate water quantity and availability by identifying water users potentially impacted by alterations in water quantity and availability:

(a) Describe any impacts of reduced water quantity and availability.

(b) Describe the possibility for inequalities between proposed construction water use and existing and known future water rights and allocations and the probable nature and extent of these inequalities.

(2) Evaluate the construction activities and the hydrologic alterations identified in ESRP 4.2.1 with respect to their potential impacts to water users or water-use areas:

(a) Compare the effects of these alterations (e.g., increased temperature, salinity, erosion, sedimentation) with pre-construction conditions to assess the magnitude of the impact.

(b) Evaluate the impacts for individual water users and for water-use areas.

(c) Identify and describe proposed construction or construction activities located on a floodplain or wetland as follows:

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

- Ensure that the analysis has considered short-term effects (e.g., floodplain alterations resulting from temporary construction structures or activities) as well as the long-term alteration caused by the completed plant.

- Consult with the reviewer for ESRP 4.2.1 and the reviewers for ESRP 9.4.1 to analyze alternatives to any proposed activity located in the floodplain.

The intent of this instruction is to ensure that alternatives to avoid adverse effects and incompatible development in a floodplain or wetland have been considered.

(d) Identify construction and construction activities that will alter or restrict shoreline access (e.g., beach closure) and surface oriented water uses (e.g., commercial and recreational fishing, navigation) including the following:

- Describe the effects of construction to water users.

- If potential adverse impacts are predicted, identify alternative design, construction practices, or procedures that could mitigate or avoid the impacts.

(3) Analyze water quality:

(a) Identify hydrologic alterations and construction activities affecting water quality and describe their effects on water users or water-use areas.

(b) Describe the time duration or time periods when the impact will be experienced, and the number of water users or extent of water-use areas affected. (When necessary, consult with Federal, State, regional, local, and affected Native American tribal agencies for assistance in evaluating the identified impacts.)

(c) Review consultation with appropriate agencies regarding compliance with Federal, State, regional, local, and affected Native American tribal water-quality standards.

The reviewer's analysis of construction impacts on water use should be coordinated with the hydrologic alteration descriptions provided by the environmental review for ESRP 4.2.1. This coordination should ensure that the environmental factors most likely to be impacted by hydrologic alterations are described in sufficient detail to permit assessment of the predicted impacts. The reviewer should independently identify and analyze those construction activities expected to affect the quality of receiving water bodies. The reviewer should consult with the reviewers for ESRPs 2.3.2, 4.1, 4.3, and 4.4 to establish the location and nature of those water users potentially impacted by hydrologic alterations and water-quality changes.

The reviewer should take the following steps:

(1) Analyze reduced water availability:

(a) Initiate this analysis if the reviewer for ESRP 4.2.1 determines that construction activities will result in decreased water availability.

(b) When this is predicted to occur, identify the location of those water users likely to be affected and consult with the reviewer for ESRP 4.2.1 to determine the hydrologic effects at these locations.

(c) Consider these effects (e.g., lowered groundwater table, reduced well yields, lowered surface-water levels at intake structures) and determine their impacts on individual water users or water-use areas.

(d) Consider seasonal requirements for water and temporal variations in water availability.

(e) Consider the potential for impacts when the reviewer for ESRP 4.2.1 predicts an incompatibility between water availability as affected by project construction activity and existing and known future water rights and allocations. For these cases, analyze the potential for future inequalities in water availability to determine their probable nature and extent.

(2) Analyze the construction activity and hydrologic alterations identified by the reviewer for ESRP 4.2.1 and compare them with present and predicted future water uses that could be affected:

(a) Analyze in further detail any alterations that can be shown to represent a potential for water-use impacts.

(b) Consider both short-term impacts (e.g., from temporary channel diversions) that will occur only during the construction period, and long-term impacts (e.g., channel restriction by a breakwater) that will occur for the period of plant operation.

(c) Identify individual water users or water-use areas and predict impacts to these users or areas.

(d) Identify the proposed construction activities that will restrict non-consumptive water use or water access and identify the water users so affected, categorizing the impacts as either short- or long-term.

(e) Give special consideration to hydrologic alterations that affect floodplains. When such alterations are predicted, consult with the reviewer for ESRP 4.1.1 or 4.1.2 to complete the analysis of any resulting impacts.

(3) Analyze water quality by considering the construction activities and hydrologic alterations expected to result in altered water quality and the water users or water-use areas that could be impacted by the water-quality alterations:

(a) Consult with the reviewer for ESRP 4.2.1 to identify the affected receiving water bodies and the hydrologic alterations (e.g., erosion, sedimentation) that could affect water quality.

(b) Consult with the reviewer for ESRP 2.3.3 to determine the baseline water quality of the receiving water bodies and with the reviewer for ESRP 2.3.2 to identify potentially affected water users.

(c) Identify the water bodies receiving construction effluents, the flow rates and chemical composition of these effluents, and the potential for and nature of any contaminants that could be released to surface or groundwater as a result of substrate exposure during construction.

(d) Consider potential impacts to water users in terms of the intended usage (e.g., heavy metals as a contaminant affecting a municipal water supply, suspended solids affecting industrial use).

(e) Consult with nearby Federal, State, regional, local, and affected Native American tribal agencies in analyzing potential water-quality impacts.

(f) Finally, consult with the reviewer for ESRP 4.3.2 to coordinate the analysis of impacts to water quality and to avoid any duplication of effort in this analysis.

IV. EVALUATION FINDINGS

Input from this ESRP to the environmental impact statement (EIS) should accomplish the following objectives: (1) public disclosure of major direct water-use consequences of proposed project construction, (2) presentation of the basis for the staff analysis, and (3) presentation of staff conclusions and conditions regarding water use. The reviewer should coordinate this input with the reviewer for ESRP 4.2.1 to avoid duplication.

The following information should be included in the EIS:

- a description of plant design and construction activities that may cause adverse water-use impacts and a quantitative description of these impacts for each affected water body. For plant facilities and construction activities located on the floodplain, the description should include (1) staff conclusions as to the necessity of such location (e.g., intake structures) and a discussion of applicant commitments or staff recommendations for actions to minimize environmental harm to the floodplain, (2) reference to appropriate ESRP 9.4 discussion of alternatives to facility or activity location in the floodplain, and (3) discussion of the extent of conformance with applicable State or local floodplain protection standards.

- comparison of predicted effluent and receiving water quality with applicable effluent limitations and water-quality standards, and conclusions with respect to project compliance with these standards

- the physical impacts of consumptive water uses during construction (e.g., groundwater depletion) on other water users

- the compatibility of proposed construction water use with existing and known water rights and allocations

- adverse impacts on surface oriented water users (e.g., fishing, navigation) resulting from plant construction and construction activity

- construction practices and procedures to mitigate potential adverse water-use impacts or consider alternative project designs to avoid these impacts.

Evaluation of each identified impact should 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 EPM and the appropriate ESRP 9.4 reviewer for verification that the reviewer's identified 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 the reviewer for ESRP 4.6.

- *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 9.4.1 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 be responsible for providing 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."

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."

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

4.3 ECOLOGICAL 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 ecological impacts of construction. The scope of the paragraph covered by this plan introduces the material from the reviews conducted under ESRPs 4.3.1 and 4.3.2.

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 ecological 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 4.3.1 and 4.3.2. 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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

4.3.1 TERRESTRIAL ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's description, quantification, and assessment of the impacts of construction on the terrestrial ecosystem. The scope of the review directed by this plan includes an assessment of both onsite and offsite construction, including transmission line and access corridor construction. The assessment should be in sufficient detail to (1) predict and evaluate the significance of potential impacts to "important" species and their habitats and (2) evaluate how these impacts should be considered in the licensing decision. If necessary, the reviewer should suggest consideration of alternative designs or construction practices, or licensee commitments to mitigate the intensity of environmental 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 needed to support the analyses made in ESRP 4.3.1. The reviewer for ESRP 4.3.1 should also provide input on significant impacts of construction to the terrestrial environment.

- ESRP 3.1. Obtain information about the power plant's external appearance and layout in enough detail to support the analyses made in ESRP 4.3.1.

- ESRP 3.4.2. Obtain information on cooling system in enough detail to support analysis of bird impacts with cooling towers.

- ESRP 3.7. Obtain information about the power transmission system in enough detail to support the analyses made in ESRP 4.3.1.

- ESRP 4.1.1. Obtain information regarding impacts of construction on land use onsite and in the vicinity of the plant to complete the description of construction impacts on the terrestrial ecosystem.

- ESRP 4.1.2. Obtain information regarding impacts to land use in transmission corridors and offsite areas to complete the description of construction impacts on the terrestrial ecosystem.

- ESRP 4.2.2. Obtain information regarding impacts on water use to complete the description of construction impacts on the terrestrial ecosystem.

- ESRP 4.4.2. Provide information regarding impacts to the terrestrial ecosystem from construction so that an evaluation of social and economic impacts from construction can be completed.

- ESRP 4.6. Provide a list of applicant commitments and staff evaluations of practices to limit adverse environmental impacts of construction.

- ESRP 6.5.1. Provide appropriate information on impacts to the terrestrial environment from construction activities in sufficient detail to allow for the evaluation of the applicant's proposed monitoring program.

- ESRP 9.4. If the reviewer determines that a proposed construction activity will result in an adverse environmental impact that cannot be mitigated by alternative construction practices and procedures, then provide the reviewer of ESRP 9.4 with a notification that alternative locations and plant or component designs should be considered.

- ESRP 10.1. Provide a brief summary of the unavoidable impacts predicted to occur during construction. For example, this should be limited to the more significant impacts, such as modification of habitat for "important" species.

- ESRP 10.2. Provide a brief summary of irreversible and irretrievable commitments of terrestrial resources predicted to occur during construction. For example, this would include permanent loss of terrestrial habitat or loss of wetlands.

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 site and vicinity data or information (in addition to that listed in ESRP Section 2.4.1) should be obtained:

- a site map showing proposed buildings, the land to be cleared, waste disposal areas, the construction zone, and the site boundary (from the environmental report [ER] and ESRP 3.1)
- the proposed schedule of construction activities
- clearing methods; temporary and permanent erosion, runoff, and siltation control methods; dust suppression methods; and other construction practices for control or suppression specific to the site (from the ER)
- the total area of land to be disturbed (from the ER)
- the maximum area of soil to be exposed at any one time (from the ER)
- the area (hectares) of each plant community and habitat type to be cleared or disturbed (e.g., marshes, agricultural fields, and deciduous forests) and how much is being destroyed relative to the total amount present in the region (from the ER)
- the area to be covered by permanent station facilities, including new ponds and lakes (from the ER)
- the area to be used on a short term basis during construction, and plans for restoration of this land (from the ER)
- any proposed construction activity expected to impact “important” habitat (from the ER)
- documentation that the applicant has consulted with the appropriate Federal, State, regional, local, and affected Native American tribal agencies (e.g., as required by the U.S. Fish and Wildlife Coordination Act) (from the ER)
- identification of other Federal and State projects within the region that affect or could potentially affect the same threatened and endangered species (or their habitats) that occur on or near the site (from the ER)
- an estimate of the potential for bird collisions with cooling towers or other elevated construction equipment or plant structures (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies)

Additional background information about the terrestrial ecology of the site and vicinity, necessary for this review of impacts on terrestrial resources from construction, is requested in ESRP Section 2.4.1 and can be found in the ER, general literature, and from consultation with Federal, State, regional, local, and affected Native American tribal agencies.

The following data and information about transmission corridors and offsite areas should be obtained:

- clearing methods, erosion, runoff and siltation control methods (both temporary and permanent), dust suppression methods, and other construction practices for impact control or minimization specific to the proposed transmission system (from the ER).

- potential for bird collisions with transmission towers or lines (from the ER and consultation with Federal, State, regional, local, and affected Native American tribal agencies).

Additional background information about the terrestrial ecology of transmission corridors and offsite areas, necessary for this review of impacts to terrestrial resources from construction, is requested in ESRP 2.4.1 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 construction impacts on terrestrial ecology in the vicinity of the site and transmission corridors are based on the relevant requirements of the following:

- 10 CFR 51.71(d) with respect to including in the EIS information on impacts to the terrestrial environment due to construction

- Bald and Golden Eagle Protection Act with respect to the prohibition of taking, possessing, selling, transporting, importing, or exporting the bald or golden eagle, dead or alive, without a permit

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

- Endangered Species Act with respect to identifying impacts to threatened or endangered species and critical habitats by means of informal and/or formal consultations with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service

- Fish and Wildlife Coordination Act with respect to consideration of fish and wildlife resources and the planning of development 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 or other parts of 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 positions and specific criteria necessary to meet the regulations and other statutory requirements identified above are as follows:

- 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 (CWA).

- Memorandum of Understanding between the Corps of Engineers, U.S. Army, and the NRC for the Regulation of Nuclear Power Plants, 40 FR 60115, provides guidance 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.

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (1998), contains guidance that the ecological systems and biota at potential sites and their environs should be sufficiently well known to allow reasonably certain predictions of impacts that there would be no unacceptable or unnecessary deleterious impacts on populations of important species or on ecological systems from the construction of a nuclear power station.

- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (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 are included in the ER.

Technical Rationale

The technical rationale for evaluating the applicant's potential construction or refurbishment impacts on terrestrial ecosystems is discussed in the following paragraph:

Construction of a nuclear power facility will directly impact the terrestrial environment. This section of the ESRP reviews and evaluates the impacts that are anticipated from the construction process. This information can then be used in other ESRPs to balance the environmental effects of construction of the proposed facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental benefits of the proposed action. The acceptance criteria listed above should be used to ensure that the environmental impacts of the proposed action are considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

When reviewing the impacts of station construction on the terrestrial ecology, the reviewer should take the following steps:

(1) Review the general data and information necessary to determine the impacts on the terrestrial ecology from station construction:

(a) Identify the construction activities that impact "important" species and habitats of the site and vicinity, transmission corridors, and offsite areas (definition of "important" resources can be found in Table 2.4.1-1).

(b) Determine the areal extent and location of such potential impacts:

- Prepare a map superimposing impact areas over resource areas.

- During the site visit, inspect areas where construction activities will occur and inspect all other potentially impacted areas.

- When necessary, supplement the data and information specified in the "Review Procedures" through consultations with Federal, State, regional, local, and affected Native American tribal agencies (e.g., the U.S. Fish and Wildlife Service and State wildlife agencies).

(2) Review impacts of station construction on terrestrial ecology:

(a) Review and discuss the following impacts:

- the number of hectares of plant community types preempted and the number of hectares modified by construction activities. Describe how construction activities will disturb the existing terrain and wildlife habitats.

- Estimate the magnitude of the impact for important species that have commercial or recreational value. This may be expressed in terms of dollars, lost opportunity for recreational pursuits, percent reduction in harvest, percent loss of habitat, or other appropriate quantifiers.

- Consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service under Section 7 of the Endangered Species Act, if threatened or endangered species or critical habitat are known to occur in the project area and the proposed project is predicted to add to their further endangerment.

- the impact of habitat modification (e.g., tree removal) on associated animal populations
- an evaluation of the impacts of construction on "important" species relative to effects on the local population and the total population of the species
- the effects of noise on "important" species
- construction activities that create obstacles to the movements of vertebrates or result in increased dispersal of invertebrate species known to be important as disease vectors or pests
- the potential for bird collisions with cooling towers, other elevated plant structures and construction equipment, transmission towers, and transmission lines
- changes in terrestrial habitat resulting from establishment of cooling ponds or lakes including the following:
  - construction activities that will dewater any wetlands, ponds, or seepages or alter surface drainage patterns supporting terrestrial biota
  - the adequacy of proposed plans for preventing soil erosion runoff to surface waters and revegetating disturbed soil
  - disposal of construction wastes that will need landfill or special disposal
- impacts to floodplains and wetlands on the power line right-of-way.

(b) Become familiar with the provisions of standards, guides, and agreements that are pertinent to the construction of nuclear power stations:

- Refer to the "Acceptance Criteria" section of this ESRP for a list of those that are applicable to this environmental review.
- Consult with appropriate agencies, when necessary (e.g., the U.S. Fish and Wildlife Service and the State wildlife agency) to ensure compliance with the applicable regulations.
- Analyze construction activities in light of recognized "good practice." The term "good practice" as used here will refer to those construction activities that tend to mitigate adverse environmental impacts.

IV. EVALUATION FINDINGS

Input to the EIS should include (1) a list of adverse impacts of construction 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 and provided to the reviewer of ESRP Section 4.6.

Any construction activity that should receive mitigative action should be described by the staff. Where mitigation is an option, the reviewer should evaluate appropriate measures, which could include alternative placement of structures, alternative schedules, or alternative construction practices. The reviewer should also evaluate alternatives for any proposed construction activity that is predicted to result in an adverse impact that cannot be mitigated. Practices proposed by the applicant for the protection of the environment should be described if the reviewer determines that they are necessary.

The depth and extent of the input to the EIS should be governed by the attributes of the terrestrial ecological resources that could be affected by plant construction and operation, and by the nature and magnitude of the expected impacts to those resources. However, the following should be evaluated for inclusion by the reviewer in the EIS:

- loss of habitat for endangered or threatened species in the context of guidelines under the Endangered Species Act of 1973. Where loss of habitat for commercially or recreationally important species occurs, the reviewer should consider the effects on the harvestable crop. It should generally be concluded that loss of up to 5 percent of such habitat in the site vicinity will have negligible impact on the crop and need no further analysis. Where losses exceed 5 percent, the reviewer should consider the loss in relation to regional abundance of these species.

- construction practices to minimize soil erosion and the number of hectares disturbed

- the clearing of vegetation from stream banks, making certain that it is limited to that necessary for placement of structures

- the CWA amendments of 1972, the Coastal Zone Management Act of 1972, and the Marine Protection, Research, and Sanctuaries Act of 1972. Guidelines under the Acts should be followed in evaluating the significance of dewatering wetlands. Because of the importance of wetlands, any unavoidable impact to this habitat must be considered in the overall benefit-cost balancing.

- the intrusion on or destruction of terrestrial plant communities that are regarded as representative of natural, undisturbed, or remnant communities or that show unusual ecological or geographical distributions, and the loss of fragile or sensitive habitat

- the proposed procedures for compliance with EPA guidelines for drainage from dredge spoil. Filling of biologically productive wetlands is generally to be avoided. Plans for dumping of dredge spoils must be approved by the EPA and the District Office of the Corps of Engineers.

- where cooling reservoirs are to be constructed, the potential beneficial impacts (e.g., provision of water for irrigation, livestock watering, or the creation of riparian habitat) and adverse impacts (e.g., the shortstopping of migratory waterfowl) should be considered and balanced against the ecological losses associated with inundation of the land area by the reservoir.

- the applicant's commitment to the use of good construction practices

- secondary impacts on wildlife, such as altered behavior resulting from construction noise, in addition to direct impacts on animals, such as loss of habitat and road kills

- the reviewer should screen each predicted impact using criteria appropriate to the impacted segment of the ecosystem. For example, loss of more than a few percent of the habitat available in the region for an "important" species could be considered of sufficient importance to consider mitigating action.

If the reviewer verifies that sufficient information has been provided in accordance with the requirements of this ESRP section, then the evaluation supports the following type of concluding statement to be included in the EIS:

> The staff reviewed the available information relative to impacts to the terrestrial 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 51.71, "Draft environmental impact statement—contents."

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.

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* 60115, August 25, 1975.

Migratory Bird Treaty Act, as amended, 16 USC 703 et seq.

"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). 1998. *General Site Suitability for Nuclear Power Stations.* Regulatory Guide 4.7, 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

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

4.3.2 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 the impacts of construction of the proposed facilities on the aquatic ecosystem. The scope of the review directed by this plan will include an assessment of both onsite and offsite construction activities, including transmission line and access corridor construction. The assessment should be in sufficient detail to (1) predict and evaluate the significance of potential impacts to "important" species and their habitats and (2) evaluate how these impacts should be considered in the licensing decision. If necessary, the reviewer should consider alternative designs or construction practices to mitigate the intensity of environmental impacts.

Review Interfaces

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

- ESRP 2.3.1. Obtain information regarding the hydrology of the site.
- ESRP 2.3.2. Obtain a description of surface-water and groundwater uses so that the description of impacts to the aquatic ecosystem from construction or refurbishment can be completed.

- ESRP 2.3.3. Obtain information about the water-quality conditions at the site in enough detail to determine impacts to the aquatic environment from construction.

- ESRP 2.4.2. Obtain descriptions of the aquatic ecology of the site and vicinity. Provide input on the significant impacts of construction on the aquatic environment to guide the reviewer of ESRP 2.4.2 in preparing a more detailed description of the part(s) of the environment that will be significantly affected.

- ESRP 3.1. Obtain information about the power plant's external appearance and layout in enough detail to support the analyses made in ESRP 4.3.2.

- ESRP 3.4.2. Obtain a description of the intake, discharge, and heat dissipation system design and performance characteristics so that a description of impacts on the aquatic ecosystem from construction can be completed.

- ESRP 3.6.2. Obtain a description of sanitary system effluents and their treatment so that a description of impacts on the aquatic ecosystem from construction can be completed.

- ESRP 3.7. Obtain information about the power transmission system in enough detail to support the analyses made in ESRP 4.3.2.

- ESRP 4.1.1. Obtain an evaluation of impacts of construction on land use of the site and vicinity so that a description of impacts on the aquatic ecosystem from construction can be completed.

- ESRP 4.1.2. Obtain an evaluation of impacts of construction on land use within the transmission line and access corridors and other offsite areas so that a description of impacts on the aquatic ecosystem from construction can be completed.

- ESRP 4.2.1. Obtain information about hydrological alterations and potential water-use impacts on the aquatic environment during construction.

- ESRP 4.2.2. Obtain an evaluation of the impacts on water use so that a description of impacts on the aquatic ecosystem from construction can be completed.

- ESRP 4.4.2. Provide information regarding impacts on the aquatic ecosystem from construction so that an evaluation of social and economic impacts from construction can be completed.

- ESRP 4.6. Provide a list of applicant commitments and staff evaluations of practices to limit adverse environmental impacts of construction.

- ESRP 6.3. Provide information on impacts on the aquatic ecosystem from construction so that an evaluation of the hydrological monitoring programs can be completed.

- ESRP 6.5.2. Provide information on impacts on the aquatic environment from construction in sufficient detail to permit evaluation of the applicant's proposed monitoring program.

- ESRP 6.6. Provide information on impacts on the aquatic ecosystem from construction so that a description and evaluation of the water-quality monitoring programs can be completed.

- ESRPs 9.3 and 9.4. Provide a notification to the reviewers of ESRPs 9.3 and 9.4 that alternative locations and plant or component designs should be considered if the reviewer determines that a proposed construction activity will result in an adverse environmental impact that cannot be mitigated by alternative construction practices and procedures.

- ESRP 10.1. Provide a brief summary of the unavoidable impacts that are expected to occur during construction. This should be limited to the more significant impacts (e.g., temporary loss of habitat for "important" species).

- ESRP 10.2. Provide a brief summary of irreversible and irretrievable commitments of aquatic resources that are expected to occur during construction. For example, this would include any permanent loss of aquatic habitat or loss of wetlands.

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 site and vicinity data or information should be obtained:

- a map of the site and vicinity delineating areas of construction, particularly those where habitat of "important" species (see definition in Table 2.4.2-1) is expected to be altered, such as areas to be cleared along stream banks and areas proposed for the disposal of dredged material (from the environmental report [ER] and ESRP Section 3.1)

- the proposed schedule of construction activities

- the clearing methods, temporary and permanent erosion, runoff, and siltation control methods, dust suppression methods, and other construction practices for control or suppression specific to the site (from the ER)

- the area of disturbance for each habitat type listed in the top two items above and the total aquatic area to be disturbed, and an estimate of the amount of these habitats that will be destroyed relative to the total amount present in the region (from the ER)

- the aquatic areas to be covered by permanent station facilities (from the ER)

- any proposed construction or refurbishment activity expected to impact “important” species and habitats (from the ER)

- tolerances and/or susceptibilities of “important” biota to physical and chemical pollutants of construction origin (from the ER and the general literature).

Additional background information about the aquatic ecology, hydrology, water quality, and the impacts of hydrological alterations and water use, that is necessary for this review of impacts on aquatic resources from construction, should be obtained from the reviewers of ESRPs 2.3.1, 2.3.2, 2.3.3, 2.4.2, and 4.2, the ER, and from consultation with Federal, State, regional, local, and affected Native American tribal agencies.

The following data and information about transmission corridors and offsite areas should also be obtained:

- the clearing methods, erosion, runoff and siltation control methods (both temporary and permanent), dust-suppression methods, and other construction practices for impact control or minimization that are specific to the proposed transmission system (from the ER).

- the water bodies and wetlands crossed or spanned that are expected to have tower foundations located within them (from the ER)

- the location and areal limits of construction activities having impacts on aquatic environs (from the ER and ESRP 4.2)

- a description of the magnitude and schedule of construction activities that are expected to impact “important” aquatic species and their habitats (from the ER and ESRP 4.2).

Additional background information about the aquatic ecology along the transmission corridors and offsite areas, necessary for this review of impacts on aquatic resources from construction, should be obtained from the reviewer of 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 construction impacts on aquatic ecology in the vicinity of the site and transmission corridors are based on the relevant requirements of the following:

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

- Endangered Species Act of 1973 with respect to identifying impacts on threatened or endangered species and critical habitats by means of informal and/or formal consultations 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), of 1948 with respect to activities associated with the discharge of dredge or fill materials into waters of the United States

- FWPCA 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 of fish and wildlife resources in planning 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

- Rivers and Harbors Appropriations Act of 1899 with respect to construction of any bridge, causeway, dam, or dike over or in any port, roadstead, haven, harbor, canal, navigable river, or any other navigable water of the United States.

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

- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998), contains guidance that the ecological systems and biota at potential sites and their environs should be sufficiently well known to allow reasonably certain predictions of impacts and that there would be no unacceptable or unnecessary deleterious impacts on populations of important species or on ecological systems from the construction of a nuclear power station.

- Memorandum of Understanding between the Corps of Engineers, U.S. Army, and the NRC for the Regulation of Nuclear Power Plants, 1975, provides guidance with respect to the NRC exercising the primary responsibility in conducting environmental reviews and in preparing environmental impact statements (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 CWA.

Technical Rationale

The technical rationale for evaluating the applicant's construction impacts on aquatic ecosystems is discussed in the following paragraph:

The EIS needs to include an analysis that considers the environmental and other effects of construction on the aquatic environment and the alternatives available for reducing or avoiding adverse environmental and other effects, as well as the environmental benefits of the proposed action. Following the acceptance criteria listed above will help ensure that the environmental impact of the proposed action is considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

When reviewing the impacts of station construction on aquatic ecology, the reviewer should take the following steps:

(1) Review the general data and information necessary to determine the impacts of station construction on aquatic ecology:

(a) Identify the construction activities that impact "important" aquatic species and habitats of the site and vicinity, transmission corridors, and offsite areas.

(b) Determine the areal extent and location of such potential impacts.

- Prepare a map superimposing impact areas over resource areas.

- During the site visit, inspect areas where construction activities will occur, and inspect all other potentially impacted areas.

- When necessary, supplement the data and information specified in this part through consultations with Federal, State, regional, local, and affected Native American tribal agencies (e.g., the U.S. Fish and Wildlife Service and State fish and wildlife agencies).

(2) Review impacts of construction on aquatic ecology:

Review and discuss the following impacts:

(a) Determine how construction activities will impact "important" species and their habitats (e.g., those resulting from scouring and siltation, dredging and soil disposal, and interference with shoreline processes), and estimate the magnitude and duration of such impacts.

(b) Determine the impacts of construction on threatened or endangered species, evaluating these impacts relative to the local population and the total estimated population over the entire range of the species as noted in the literature.

(c) Identify water bodies receiving construction effluents and the expected average and maximum flow rates, composition, and physical characteristics of these effluents (from ESRP 4.2).

(d) Describe proposed construction management practices for the amelioration of impacts (from the ER). For example,

- avoid narrow reaches of water bodies and important habitats as sites for locating intake or discharge structures

- provide a zone of passage that permits normal movement of "important" species populations and maintenance of the harvestable crop of economically important populations.

(e) For important species having commercial or recreational value, estimate the magnitude of the impact. This may be expressed in terms of dollars, lost opportunity for recreational pursuits, percent reduction in harvest, percent loss of habitat, or other appropriate quantifiers. In absence of more sophisticated population models, these determinations can usually be based on percent of habitat type lost.

(f) If threatened or endangered species are known to occur in the project area, and the proposed project is predicted to add to their further endangerment, consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service under Section 7 of the Endangered Species Act.

(g) Identify potential disturbances of benthic areas by

- placement of intake and discharge structures
- channel modifications for navigation or flow control
- placement and removal of cofferdams
- construction of bulkheads, piers, jetties, basins, and storm sewers
- direct dredging, including the area that may be affected by resulting siltation and turbidity.

(h) Analyze the importance of these disturbed benthic areas to "important" species, taking into account the relationship between the area disturbed and the remaining comparable undisturbed area in the region available for the continued maintenance of impacted biota.

(i) Relate the critical life history and habitat needs of “important” fish and shellfish (e.g., seasonal requirements, migration routes, spawning areas, nursery grounds, and feeding and wintering areas) to the plant construction schedule and consider whether impacts are likely to be of short duration or otherwise reversible.

(j) In analyzing such impacts, consider

- percent of the water body cross section that might be obstructed by construction activity at any time
- time and duration of such obstruction
- potential changes to water quality caused by exposure of substrate to contaminants during construction (e.g., dredging for intake channels, cofferdam construction)
- coordinating this review with the District Office of the Corps of Engineers.

(k) Identify sediments, petroleum products, pesticides, fertilizers, heavy metals, and other potential pollutants entering affected water bodies.

- Consider both the points of entry of site drainage into surface-water bodies and the areal extent of impact by suspended materials and siltation.
- Determine the potential for reversibility of impacts following completion of construction.
- Assess plans for maintenance of siltation ponds or catchment basins.

(l) Identify potential clearing along reaches of streams, rivers, and other water bodies.

- Identify water bodies where such habitat alterations will occur and indicate the extent of such changes.
- Compare this with the extent of remaining similar habitats in the region.

(m) Identify potential dewatering effects on groundwater supply, wetlands (protected under Executive Order 11990 as amended by Executive Order 12608), and other aquatic habitats.

- Consider the location and areal extent of any wetlands that will be drained.
- Determine the relative extent of comparable wetlands in the region and, as in item (g) above, address the relative importance to the ecosystem of the impacted wetlands in comparison with the regional wetlands.

- Examine the potential for reversibility of impacts and environmental improvement following construction.

(n) Identify disposal plans for dredged material and placement of fill material.

- Identify the areal extent of any water bodies or wetlands that would receive dredge spoils during construction.

- Consider the relative extent of similar water bodies and wetlands in the region, and in this context, analyze the importance of the impacted wetlands and water bodies to the ecosystem.

- Coordinate this review with the District Office of the Corps of Engineers.

(o) Ensure that aquatic species expected to become established in cooling ponds are identified.

- Ensure that the applicant has described in the ER the aquatic species that are expected to become established in cooling ponds.

- Consider how these colonizations may impact aquatic species in adjacent water bodies and wetlands in the site and vicinity.

(p) In addition to the above analyses (items a-p), consider any other site-specific construction impacts to aquatic ecosystems that can be predicted on the basis of construction and the local aquatic ecosystem, consulting with the reviewers for ESRPs 2.3, 2.4.2, 3.6, and 4.2 to identify such additional impacts.

(q) Ensure that initial evaluation of environmental impacts has been submitted by the applicant if the applicant wishes to accelerate the start of construction.

- Ensure that an applicant wishing to accelerate the start of construction by early submittal of the ER has submitted in the ER an initial evaluation of environmental impacts based on an analysis of at least 6 months of field data related to the proposed facility and suitable projections of the remaining seasonal periods if information has already been provided on the critical life stages and biologically significant activities (e.g., spawning, migration) that increase the vulnerability of the potentially affected biota at the proposed site.

- If this has been done, the reviewer should ensure that the applicant makes a commitment to furnish, within 6 months of the time of filing, a final evaluation based on a full year of field data.

(r) Become familiar with the provisions of standards, guides, and agreements pertinent to the construction of nuclear power stations:

- Refer to the "Acceptance Criteria" section of this ESRP for a list of the standards that are applicable to this environmental review.

- Where required by these provisions, consult with the reviewers of ESRP 2.3 and with appropriate agencies (e.g., the U.S. Fish and Wildlife Service and the State wildlife agency) to ensure compliance with the applicable regulations.

- Analyze construction activities in light of recognized best management practices.

IV. EVALUATION FINDINGS

Input to the EIS should include (1) a list of adverse impacts of construction 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 by the reviewer of ESRP Section 4.6.

For all construction activities, the commitment of aquatic resources should be indicated. The reviewer should also evaluate the proposed construction activities to ensure that the applicant is planning to use generally acceptable practices that should result in minimizing impacts associated with such practices (see 40 CFR 423.40). Practices and commitments proposed by the applicant for the protection of the environment should be described.

Any construction activity that should receive mitigative action should be described by the staff. Where mitigation of a predicted impact is an option, the reviewer should evaluate appropriate measures, which could include alternative placement of structures, alternative schedules, or alternative construction practices. The reviewer should evaluate alternatives for any proposed construction activity that is predicted to result in an adverse impact that cannot be mitigated.

The depth and extent of the input to the EIS will be governed by the attributes of the aquatic ecological resources that could be affected by plant construction and operation, and by the nature and magnitude of the expected impacts to these resources. The reviewer should screen each predicted impact using criteria appropriate to the impacted segment of the ecosystem. The following should be evaluated by the reviewer for inclusion in the EIS:

- loss of habitat for endangered or threatened species in the context of guidelines under the Endangered Species Act of 1973. If loss of habitat for commercially or recreationally important species occurs, the reviewer should consider the effects on the harvestable crop. It should generally be concluded that loss of up to 5% of such habitat in the site vicinity will have negligible impact on the crop and need no further analysis. Where losses exceed 5%, the reviewers should consider the loss in relation to regional abundance of these species.

- construction practices to minimize soil erosion and the number of hectares disturbed

- the clearing of vegetation from stream banks, making certain that it is limited to that necessary for placement of structures

- the applicant's commitment to the use of best management practices

- alternatives to mitigate such impacts, such as using a fish hatchery and habitat restoration to increase natural fish production, if the applicant's ER reveals a potential significant impact on fish populations

- lost "important" aquatic species and habitats from the viewpoints of their uniqueness within the region under consideration, relative impacts, and long term net effects

  - The assessments of relative impacts should include statements expressed in percentage terms in which the amount of expected resource loss is related to the total resource in the immediate region and in which the total resource in the immediate region is related to that in the surrounding regions.

  - The assessments of long term net effects should include statements about whether impacts represent long-term net losses, long-term net gains, or something in between. For example, short term impacts to individuals in the local impact area may be severe while long-term impacts to the local population may represent no net losses.

- disturbance of benthic areas. All dredged areas or areas affected by dredging may be considered as temporarily lost habitat; therefore dredging should be limited, if possible.

- surface runoff. Good construction practices will generally control surface runoff. Where drainage courses represent an especially important resource, attention should be given to measures for their protection during construction or refurbishment. The reviewer should (1) determine if construction activities affecting water quality (e.g., runoff, turbidity) will comply with Federal, State, regional, and local water-quality standards, and (2) reach a conclusion as to whether controls proposed by the applicant will ensure satisfactory protection of surface waters.

- dewatering on wetlands. Guidelines under the CWA Amendments of 1972, the Coastal Zone Management Act of 1972, and the Marine Sanctuaries Act of 1972 should be followed in evaluating the significance of dewatering on wetlands. Generally, dewatering of biologically productive wetlands may be considered an adverse impact that should be avoided. The percentage loss of such wetlands in the region should be considered to place the loss in perspective for the licensing decision. Because of the importance of wetlands, alternatives to avoid any loss of this habitat should always be considered.

- dredge spoils and placement of fill. Drainage from dredge spoil areas should comply with existing EPA guidelines. The reviewer should reach a conclusion about whether adequate practices have

been provided for management of this stage of construction. Filling of biologically productive wetlands should generally be avoided. Dumping of dredge spoils should be performed under the cognizance of the EPA and the District Office of the Corps of Engineers.

If the reviewer verifies that sufficient information has been provided in accordance with the requirements of this ESRP section, then the evaluation supports the following types of concluding statements to be included in the 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."

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

Executive Order 11990, "Protection of Wetlands."

Executive Order 12608, 52 *Federal Register* 34617, September 9, 1987.

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.

Rivers and Harbors Appropriations Act of 1899, 33 USC, 403 et seq.

"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). 1998. *General Site Suitability for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2, 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."

U.S. NUCLEAR REGULATORY COMMISSION

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)]

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

- 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 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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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 micro-organisms 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

5.10 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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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."

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

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.