GUIDE TO THE PREPARATION OF ENVIRONMENTAL REPORTS FOR NUCLEAR POWER PLANTS

U.S. ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY STANDARDS

AUGUST 1972

ISSUED FOR COMMENT

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NATIONAL ENVIRONMENTAL GOALS

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The national environmental goals as expressed by the National Environmental Policy Act (NEPA) are as follows:

> "...it is the continuing responsibility of the Federal Government to use all practical means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may–
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> "(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
> "(2) assure for all Americans safe, healthful, productive and esthetically and culturally pleasing surroundings;
> "(3) attain the widest range of beneficial use of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
> "(4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
> "(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
> "(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The obligation of the Commission with respect to the furthering of the above aims derives from Executive Order 11514 (35 F.R. 4247) of March 4, 1970, by which all Federal agencies were required, to the fullest extent possible, to direct their policies, plans and programs to meeting the goals set out in NEPA.

On April 2, 1970, the Commission's initial implementation of NEPA was published (35 F.R. 5463) as an Appendix D to 10 CFR Part 50. Substantial amendments to Appendix D were published on December 4, 1970 (35 F.R. 18469), and further minor amendments on July 7, 1971 (36 F.R. 12731). On September 9, 1971, a major revision of Appendix D, entitled "Interim Statement of General Policy and Procedure: Implementation of the National Environmental Policy Act of 1969 (P. L. 91-190), was published (36 F.R. 18071). A copy of Appendix D, with amendments to May 18, 1972, is attached as Appendix 1.

APPLICANT'S ENVIRONMENTAL REPORTS

The revised Appendix D of 10 CFR 50 discusses, in the first five paragraphs of Section A, the required content of the Environmental Reports to be submitted by the applicant:

> "1. Each applicant[1] for a permit to construct a nuclear power reactor...shall submit with his application three hundred copies...of a separate document, entitled 'Applicant's Environmental Report–Construction Permit Stage,' which discusses the following environmental considerations:
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> "(a) the environmental impact of the proposed action,
> "(b) any adverse environmental effects which cannot be avoided should the proposal be implemented,
> "(c) alternatives to the proposed action,
> "(d) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

[1] Where the "applicant", as used in the Appendix, is a Federal agency, different arrangements for implementing the National Environmental Policy Act may be made, pursuant to the guidelines established by the Council on Environmental Quality.

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"(e) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

"2. The discussion of alternatives to the proposed action in the Environmental Report required by paragraph 1 shall be sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102(2)(D) of the National Environmental Policy Act, 'appropriate alternatives . . . in any proposal which involves unresolved conflicts concerning alternative uses of available resources.'

"3. The Environmental Report required by paragraph 1 shall include a cost-benefit analysis which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental, economic, technical and other benefits of the facility. The cost-benefit analysis shall, to the fullest extent practicable, quantify the various factors considered. To the extent that such factors cannot be quantified, they shall be discussed in qualitative terms. The Environmental Report should contain sufficient data to aid the Commission in its development of an independent cost-benefit analysis covering the factors specified in this paragraph.

"4. The Environmental Report required by paragraph 1 shall include a discussion of the status of compliance of the facility with applicable environmental quality standards and requirements (including, but not limited to, thermal and other water quality standards promulgated under the Federal Water Pollution Control Act) which have been imposed by Federal, State and regional agencies having responsibility for environmental protection. In addition, the environmental impact of the facility shall be fully discussed with respect to matters covered by such standards and requirements irrespective of whether a certification from the appropriate authority has been obtained (including, but not limited to, any certification obtained pursuant to section 21(b) of the Federal Water Pollution Control Act[2]). Such discussion shall be reflected in the cost-benefit analysis prescribed in paragraph 3. While satisfaction of AEC standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis prescribed in paragraph 3 shall, for the purposes of the National Environmental Policy Act, consider the radiological effects, together with the thermal effects and other environmental effects, of the facility.

"5. Each applicant for a license to operate a production or utilization facility described in paragraph 1 shall submit with his application three hundred (300) copies . . . of a separate document to be entitled 'Applicant's Environmental Report–Operating License Stage,' which discusses the same environmental considerations described in paragraphs 1-4, but only to the extent that they differ from those discussed in the Applicant's Environmental Report previously submitted in accordance with paragraph 1. The 'Applicant's Environmental Report–Operating License Stage' may incorporate by reference any information contained in the Applicant's Environmental Report previously submitted in accordance with paragraph 1. With respect to the operation of nuclear power reactors, the applicant, unless otherwise required by the Commission, shall submit the 'Applicant's Environmental Report–Operating License Stage' only in connection with the first licensing action that would authorize full-power operation of the facility,[3] except that such report shall be submitted in connection with the conversion of a provisional operating license to a full-term license."

As is clear from the above paragraphs, two Environmental Reports are required. The first is the "Applicant's Environmental Report–Construction Permit Stage" which must be submitted in conjunction with the construction permit application. The second is the "Applicant's Environmental Report–Operating License Stage," which must be submitted later in conjunction with the operating license application. The second Report is, in effect, to be an updating of the first one and should:

a. Discuss differences between currently projected environmental effects of the nuclear power plant

[2] No permit or license will, of course, be issued with respect to an activity for which a certification required by section 21(b) of the Federal Water Pollution Act has not been obtained.

[3] This report is in addition to the report required at the construction permit stage.

(including those which would degrade and those which would enhance environmental conditions) and the effects discussed in the Environmental Report submitted at the construction stage. (Differences may result, for example, from changes in plans, changes in plant design, availability of new or more detailed information, or changes in surrounding land use or zoning classifications.)

b. Discuss the results of all studies which were not completed at the time of pre-construction review and which were specified to be completed before the pre-operational review. Indicate how the results of these studies were factored into the design and proposed operation of the plant.

c. Describe in detail the monitoring programs which have been and will be undertaken to determine the effects of the operating plant on the environment. Include the results of preoperational monitoring activities. A listing of types of measurements, kinds, and numbers of samples collected, frequencies, and analyses should be provided and the locations described and indicated on a map of the area.

d. Discuss those planned studies, that are not yet completed, that may yield results relevant to the environmental impact of the plant.

COMMISSION ACTION ON ENVIRONMENTAL REPORTS

As noted in paragraph 6 of Section A of the revised Appendix D to 10 CFR 50, the Commission places each applicant's Environmental Report in the AEC's Public Document Room in Washington, D.C. and in a local public document room near the proposed site. The Report is also made available to the public at the appropriate State, regional and metropolitan clearinghouses. At the same time, a public announcement is made and a summary notice published in the *Federal Register*.

The applicant's Environmental Report, relevant published information, and any comments received from interested persons are considered by the Commission's regulatory staff in preparing a "Draft Detailed Statement of Environmental Considerations" concerning the proposed licensing action. The regulatory staff's Draft Statement and the applicant's Environmental Report are transmitted for comment to the Council on Environmental Quality, to certain Federal agencies, and "to the Governor or appropriate State and local officials, who are authorized to develop and enforce environmental standards, of any affected State." Comments on the Report and the Draft Statement are requested within a specified time interval. The Draft Statement is made available to the general public in the same manner as the Report.

As described in detail in paragraphs 6 through 9 of Section A of the revised Appendix D, the regulatory staff considers the comments on the Report and on the Draft Statement received from the various Federal, State, and local agencies and officials, from the applicant, and from private organizations and individuals, and prepares a "Final Detailed Statement on the Environmental Considerations." The Final Statement is transmitted to the Council on Environmental Quality and is made "available to appropriate Federal, State and local agencies and State, regional, and metropolitan clearinghouses." A public announcement is made and a notice of availability published in the *Federal Register*.

Subsequent hearings and action on the environmental aspects involved in issuance of a construction permit or operating license are based on the Commission's Final Environmental Statement. The Environmental Statement takes into account information from many sources, including the applicant's Environmental Report and its supplements, and the comments of the various governmental agencies, the applicant, and private organizations and individuals.

The applicant's Environmental Report is an important document of public record. Therefore, the applicant is urged to give full attention to the completeness of the Report.

PREPARATION OF ENVIRONMENTAL REPORTS

The second Section of this Introduction, with particular reference to the paragraphs quoted from the revised Appendix D of 10 CFR 50, provides general information concerning the content of the applicant's Environmental Report. To provide specific and detailed guidance, the following "Standard Format and Content of Environmental Reports for Nuclear Power Plants" has been prepared. Each applicant should follow this format in detail.

If any topics in the guide relate to information not available at the time the Environmental Report is prepared, the applicant should indicate when the information will be available. If any topics are not relevant to the particular plant under consideration, the applicant should identify them.

Descriptive and/or narrative text as well as tables, charts, graphs, etc. should be used. Each subject should be treated in sufficient depth and should be

documented[4] to permit a reviewer independently to evaluate the extent of the environmental impact. The exact length of the Environmental Report will depend not only on the format adopted but, also and more importantly, on the nature of the plant and its environment. Tables, line drawings, and photographs should be used wherever contributory to the clarity and brevity of the Report. Descriptive and narrative passages should be brief and concise. The number of significant figures stated in numerical data should reflect the accuracy of the data.

Pertinent published information relating to the site, the plant, and its surroundings should be referenced. Where published information is essential to evaluate specific environmental effects of the plant construction and operation, it should be included, in summary or verbatim form, in the Environmental Report or as an appendix to the report.

Some of the information to be included in the Environmental Report may have already been prepared by the applicant during consideration of the safety aspects of the proposed facility. In such cases, this information (whether in the form of text, tables or figures) should be incorporated in the Environmental Report where appropriate to avoid duplication of effort.

The site for a nuclear power plant may already contain one or more "units" (i.e. steam-electric plants), either in being or for which an application for a construction permit or operating license has been filed. The applicant, in preparing the Environmental Report relating to such a site, should consider the effects of the proposed plant (and its in-service schedule) in conjunction with the effects of both pre-existing and projected[5] plants. Further, if the site contains sources of environmental impact other than electric power plants, the environmental impact of these and their interactions with the proposed plant should be taken into account.

CRITERIA AND TECHNICAL SPECIFICATIONS RELATING TO ENVIRONMENTAL IMPACT

Prior to issuance of a construction permit, the applicant will be required to prepare and submit, where applicable, proposed criteria and technical specifications relating to environmental impact. The criteria should be those identified for use in construction and operation of the facility to minimize environmental impact. The technical specifications should specify the limits of chemical and thermal releases to the environment during construction and operation. Administrative procedures, surveillance and controls to assure compliance with the proposed criteria and technical specifications should also be identified.

[4] "Documentation" as used in this Guide means presentation of evidence supporting data and statements and includes: (1) references to published information, (2) citations from the applicant's experience, (3) references to unpublished information developed by the applicant or the applicant's consultants. Statements not supported by documentation are acceptable provided the applicant identifies them either as information for which documentation is not available or as expressions of belief or judgment.

[5] Projected plants are those for which an application for a construction permit or operating license has been filed.

STANDARD FORMAT AND CONTENT OF ENVIRONMENTAL REPORTS FOR NUCLEAR POWER PLANTS

1. OBJECTIVES OF THE PROPOSED FACILITY

This Section should discuss the objectives of the proposed facility – the power requirement to be satisfied, the system reliability to be achieved, any other primary objectives to be met – and should do so in sufficient detail to make clear those aspects of the power requirement and system reliability, such as date of readiness, that will directly influence the choice of alternatives as presented in subsequent sections of the Environmental Report.

1.1 Requirement for power

This Section should discuss the requirement for the proposed nuclear unit(s) in the applicant's system and in the region, considering the overall power supply situation, present load and projected load growth, reserve margins, and consequences of delay in providing the proposed new generation capacity on adequacy and reliability of the bulk power supply. The data presented should be consistent with that furnished to the Federal Power Commission and the Regional Reliability Council.

1.1.1 Demand characteristics

The applicant should present data on the past pattern of demand characteristics and a forecast of future market trends. The presentation should include summary results of an appropriate sensitivity analysis indicating the basis of demand forecasts, such as average income, present per capita consumption, or other correlates of power demand. The data identified below should include the five years preceding the filing of the Environmental Report through at least two years beyond the projected initial date of commercial operation of the last nuclear unit with which the Report is concerned.

a) Annual system peak-hour demand,
b) Annual system peak-hour demand adjusted to reflect firm power transactions with other power suppliers, and
c) Load duration curves or information derived from such curves to indicate economic or other reasons for type of generation selected.

1.1.2 Power supply

This Section should discuss briefly the applicant's bulk power supply planning and present actual and projected generating capabilities, capacity purchases and capacity sales at the time of annual system peak-hour demand for the five years preceding filing of this Report through at least two years beyond the projected initial date of commercial operation of the last nuclear unit with which the Environmental Report is concerned.

1.1.2.1 Capacity resources

a) Capability assigned to each category of generation: hydroelectric, fossil, nuclear, pumped storage, etc.
b) Capacity sales.
c) Capacity purchases.
d) New generating units and their projected capabilities.
e) Planned retirements of present capacities for economic, environmental or other reasons.

1.1.2.2 Reserve margin

The applicant's minimum system reserve criterion should be described. The basis and justification for its adoption should be presented.

Describe the method employed to determine the minimum system reserve criterion such as single largest unit, probability method based on loss of load one day in ten years, or historical data and judgment. If probabilistic studies are used as a planning tool the results should be

stated along with the significant input data utilized, such as the load model, generating unit characteristics (including forced outage rates and maintenance schedules), the duration of periods examined, and a general description of the methodology employed.

Discuss the effect of operation of the proposed nuclear unit(s) on the applicant's minimum system reserve criterion. In addition, discuss the effects of present and planned interconnections on the minimum system reserve criterion.

Describe the minimum reserve margin responsibility to other participants of the area coordinating group or power pool.

1.1.3 System demand and resource capability comparison

Show applicant's system demand, resource capability and reserve margin with and without the proposed nuclear unit(s). The information should be presented on two graphs:

Applicant's system demand or resources (MWe) versus years: 5 curves showing capability resources with the proposed unit(s) in operation, capability resources without the proposed unit(s), annual system peak demand, generating capability with the proposed unit(s), and generating capability without the proposed unit(s).

Applicant's reserve margin (as percent of annual system peak demand) versus years: 2 curves showing reserve margin with the unit(s) and reserve margin without the unit(s).

In all graphs the years, plotted as abscissae, should be from five years preceding the date of filing of the Environmental Report through at least two years after the scheduled initial date of operation of the last unit.

1.1.4 Input and output diagram

A block diagram should be submitted showing the applicant's system power input and output (power consumption) at the time of peak-hour demand for for the first year of commercial operation.

The block diagram should represent the applicant's system capability resources (MWe), showing two categories of input: (1) the applicant's system generating capabilities (MWe) according to type (fossil, hydro, nuclear, other), and (2) the capacity transactions (MWe) and other arrangements with outside organization(s). (Identify each outside organization.)

The output of the block representing the applicant's system capability resources should consist of: (1) the peak demand (MWe) for each load market category (industrial, commercial, residential, other), and (2) the peak demand (MWe) for each wholesale market category (municipal, cooperative, other).

In addition, the output should show system firm power transactions, approximate total system losses, and system reserve, all in MWe. A separate block diagram should be provided for each generating unit with which the Environmental Report is concerned.

1.1.5 Report from Regional Reliability Council

Submit the report by the appropriate Regional Reliability Council(s) which identifies the requirement for power in the affected area.

This report should include:

a) Description of the minimum reserve criterion for the region or subregion.
b) Identification, description and brief discussion of studies conducted by the Council to determine the adequacy and reliability of power supply in the region or subregion for the first three years of commercial operation of the proposed nuclear unit(s) at the time of annual peak-hour demand.
c) The latest date the proposed nuclear unit(s) can be placed in commercial operation without endangering the adequacy and reliability of the projected bulk power supply.

1.2 Other primary objectives

If other primary objectives are to be met by the proposed facility, such as the production of process steam for sale, or desalting water, an analysis of these should be made.

1.3 Consequences of delay

The economic and other consequences of delays in the proposed project should be discussed. Where the applicant has a legal obligation to supply energy to meet the demands of a specified area, the nature and extent of this obligation should be made clear. The role of the proposed facility in fulfilling the applicant's obligation should be discussed.

The applicant should discuss the effects of delaying the scheduled in-service date of the proposed nuclear unit(s) on the adequacy and reliability of the power supply for the applicant's systems, subregion and region, as well as for other interconnected utilities in the subregion or region.

2. THE SITE

This Section should present the basic, relevant information concerning those physical, biological, and human characteristics of the area environment that might be affected by the construction and operation of a nuclear power plant on the designated site. To the extent possible, the information presented should reflect observations and measurements made over a period of years.

2.1 Site location and layout

Provide a map showing the coordinates of the site and its location with respect to State, county and other political subdivisions. On detailed maps show location of the plant perimeter, exclusion area boundary, utility property, abutting and adjacent properties, including water bodies, wooded areas, and farms, nearby settlements, industrial plants, parks and other public facilities, and transportation links (railroads, highways, waterways). Indicate total acreage owned by the applicant and that part occupied or modified by the plant and plant facilities. Indicate other uses, if any, of applicant's property and the acreage devoted to these uses. Describe any plans for site modifications, such as a visitor's center or park. A contour map of the site should also be supplied.

2.2 Regional demography, land and water use

Two maps indicating the locations and areas of towns and cities should be provided, with the first covering an area of 10-mile radius centered at the proposed plant location and the second covering an area of 50-mile radius. Each map should present the 16 cardinal compass directions identified by marked lines radiating from the reactor building location. The 10-mile map should have circles, centered at the reactor building location, of 1, 2, 3, 4, 5, and 10 miles radius; on the 50-mile map, circles with radii of 5, 10, 20, 30, 40 and 50 miles should be drawn. The populations (1970 census) of the towns and cities shown on the maps should be indicated either on the maps or in a separate tabulation.

The above maps will show 22.5° segments bounded by arcs and compass lines. Prepare a duplicate pair of maps, omitting the towns and cities, and bisect each angle formed by two adjacent compass lines with a broken line. This will generate sectors centered with respect to the compass directions. The permanent and transient populations within these sectors should be tabulated for the following: 1970 (census), year of proposed plant startup, and census years through the anticipated life of the plant.

Descriptive material should include tables giving the population and visitor statistics of neighboring schools, plants, hospitals, sports facilities, residential areas, parks, beaches, etc., within 5 miles from the plant. Indicate the nature and extent of present land use (agriculture, livestock raising, dairies, residences, industries, recreation, transportation, etc.).

Indicate the nature and extent of present water use (water supplies, irrigation, recreation, transportation, etc.) with the plant site and environs. The applicant should provide data concerning any drawdown of ground water caused by withdrawals from neighboring major industrial and municipal wells and how they may result in the transport of material from the site to those or other wells. All points of water usage of a stream or lake within 50 miles should be identified and the population associated with each use point given. In addition, all population centers taking water from waterways from the plant to the ocean should be tabulated (distance and population). Sources which are river bank wells should be tabulated separately with their associated population.

Note whether any other nuclear facilities are located within a 50-mile radius of the site.

The degree of detail to be provided will generally depend upon distance from the

plant; that is, nearby activities (within 5 miles from the plant) should be described in greater detail than those at greater distances.

2.3 Regional historic and natural landmarks

Areas valued for either their historic or natural significance may be affected. The Environmental Report should include a brief discussion of the historic and natural significance, if any, of the plant site and nearby areas with specific attention to the sites and areas listed in the *National Register of Historic Places* and the *National Registry of Natural Landmarks.* (The 1972 cumulative revision of the National Register is in the *Federal Register* of March 15, 1972, 37 F.R. 5428; additions are published in the *Federal Register* on the first Tuesday of each month.) State and local historical societies should also be consulted. In addition, indicate whether or not the site has any archaeological significance and explain how conclusions were reached. If such significance or value is present, describe plans to ensure its preservation.

State whether the proposed transmission line right-of-way from the plant to the hook-up with existing system (Section 3.9) will pass through or near any area or location of known historic, natural, or archaeological significance.

2.4 Geology

Describe the major geological aspects of the site and its immediate environs. The discussion should be limited to noting the broad features and general characteristics of the site and environs (stratigraphy, soil and rock types, faults, seismic history).

2.5 Hydrology

The effects of plant construction and operation on any adjacent above-ground or below-ground bodies of water are of prime importance. Accordingly, describe the physical, chemical, and hydrological characteristics (and their seasonal variations) of surface and ground waters (marshes, lakes, streams, estuaries, bays, oceans, etc.) of the site and the immediate environs. Include a description of significant tributaries above and below the site and the pattern and gradients of drainage in the area. Note that information relating to water characteristics should include measurements made on or in close proximity to the site.

Monthly and daily maxima, averages, and minima of important parameters of ground and surface waters, such as temperature, flow rate, velocity, water table height, gas and chemical stratification, circulation patterns, river and lake levels, tides, floods, currents, wave action, and flushing times, should be presented. Vertical and areal variations should be established on a regional basis as well as in the immediate vicinity of the site. If data are available, ground water contours (including seasonal variations) within 2 or 3 miles of the plant should be presented. (Note that water use at the site is discussed in Section 2.2.)

2.6 Meteorology

Present data on site meteorology: (1) diurnal and monthly averages and extremes of temperature and humidity; (2) monthly wind characteristics including speeds, directions, frequencies and joint wind speed, stability category, wind direction frequencies; (3) data on precipitation; (4) frequency of occurrence and effects of storms accompanied by high velocity winds including tornadoes and hurricanes. (In the second item, the joint wind speed-stability-direction frequencies should be presented in tabular form, giving the frequencies as fractions when using 5-year U.S. Weather Bureau summaries, or as number of occurrences when using only one or two years of onsite data. The data should be presented for each of the 16 cardinal compass directions, and the stability categories should be established to conform as closely as possible with those of Pasquill.)

2.7 Ecology

In this Section the applicant should identify the important local flora and fauna, their habitats and distribution as well as the relationship between species and their environments. A species, whether animal or plant, is "important" if it is commercially or recreationally valuable, if it is rare or endangered, if it is of specific scientific interest or if it is necessary to the well-being of some significant species (e.g., a food chain component) or to the balance of the ecological system.

In cataloging the local organisms, the applicant should identify and discuss the abundance of the terrestrial vertebrates, provide a map that shows the distribution of the principal plant communities, and describe the plant communities and animal populations

within the aquatic environments. The discussion should include species that migrate through the area or use it for breeding grounds.

The discussion of species-environment relationships should include descriptions of area usage (e.g. habitat, breeding, etc.); it should include life histories of important regional animals, their normal population fluctuations and their habitat requirements (e.g. thermal tolerance ranges); and it should include identification of food chains and other interspecies relationships, particularly when these are contributory to predictions or evaluations of the impact of the nuclear plant on the regional biota.

Identify any definable pre-existing environmental stresses from sources such as pollutants, as well as any ecological conditions suggestive of such stresses. Describe the status of ecological succession. Discuss any important histories of disease occurring in the regional biota as well as vectors or reservoirs of disease, or serious infestations by pest species.

The sources of information should be identified. As part of this identification, present a list of any published material dealing with the ecology of the region. Locate and describe any ecological or biological studies of the site or its environs now in progress.

2.8 Background radiological characteristics

Regional radiological data, including both natural background radiation levels and results of measurements of any concentrations of radioactive materials occurring in important biota, in soil and rocks and in regional surface waters should be reported. These data, whether determined during the applicant's preoperational surveillance program (see Section 6.1.5) or obtained from other sources, should be referenced.

2.9 Other environmental features

For certain sites, some relevant information on the plant environs may not clearly fall within the scope of the preceding topics. Additional information may be required with respect to some environmental features in order to reflect the value of the site and site environs to important segments of the population. Such information should be included here. Where relevant, the applicant should appraise and discuss the reaction of interested citizen groups to locating the proposed facility at this site.

3. THE PLANT

The operating plant and transmission system are to be described in this Section. Since the environmental effects are of primary concern in the Report, the plant effluents and plant-related systems that interact with the environment should be described in particular detail.

3.1 External appearance

The building layout, plant perimeter, exclusion boundary, and plant profile should be shown to scale by line drawings or other illustrative techniques.

The architectural design and efforts to make the structures and grounds aesthetically pleasing should be noted.

The location and elevation of release points for liquid and gaseous wastes should be clearly indicated.

3.2 Reactor and steam-electric system

The reactor type (BWR, PWR, HTGR, etc.), manufacturer, architect-engineer, number of units, and kind (make) of turbine generator should be stated. The fuel (cladding, enrichment, etc.) should be described. Rated and design electrical and thermal power of the reactor as well as the in-plant electrical power consumption should be given.

3.3 Plant water use

A quantitative water-use diagram for the plant should be presented, showing water flows to and from the various plant water systems (heat dissipation system, sanitary system, radwaste and chemical waste systems, process water system, etc.) The sources and condition (quality) of the water in each input and output should be described. Show total consumptive use of water by the plant. The above data which quantify plant water use should be tabulated for various plant conditions including maximum power operation, minimum anticipated power operation, temporary shutdown, with and without cooling towers and cooling ponds (if seasonal usage is planned). To avoid excessive detail on the diagram, cross-reference other

sections (e.g., Sections 3.4, 3.5, 3.6, 3.7) for relevant data.

3.4 Heat dissipation system

Heat-removal facilities should be discussed in detail. Simplified flow diagrams, sketches of intake and outfall structures are essential. The reasons for providing the particular facilities (such as water resources limitations or reduction of thermal effects) should be noted. The source of the cooling water should be identified. (Its natural temperature, including monthly changes and stratification, should be described in Section 2.5.)

Topics to be covered include: quantity of heat dissipated; quantity of water withdrawn, consumptive use, return; design, size, and location of cooling towers, cooling lakes or spray ponds; air, water flow rates, pertinent temperatures, estimates of quantity of drift and drizzle (and methods used in making estimates) for cooling towers; blowdown volume, rate of discharge and physical and chemical characteristics for towers and ponds; temperature changes, rate of changes and holdup times in cooling ponds; rate of evaporation of water from towers or ponds; information on dams or dikes where a cooling reservoir is created; design and location of water intake structures, including water depth, flow and velocity, screens; number and capacity of pumps at intake structure; temperature differences between withdrawn and returned water; time of travel across condenser and to end of contained discharge lines for different months and flows; details of outfall design including discharge flow and velocity. Descriptions should include operational modes of important subsystems. Describe procedures for reducing the thermal shock to aquatic biota during shutdown or refueling.

Procedures and schedules for removal and disposal of blowdown of slimes and algal growth in the system, and of trash collected at the intake structures, should be described. Data on relevant chemical constituents should be presented in Section 3.6.

3.5 Radwaste systems

Provide a detailed description of the radwaste systems including flow diagrams showing origin, treatment, and disposal of all solid, liquid, and gaseous radioactive waste generated by the plant under consideration. List estimated quantities, volumes and flow rates from all sources, expected decontamination factors, holding times, and expected frequency and magnitude of variations from normal operating conditions. (Accident conditions are to be discussed under Section 7.)

Indicate which radwaste systems are used singly and which are used jointly with other units at the site, as applicable. List all radionuclides (and their half-lives) that will be discharged with each effluent stream and give the expected annual average release rates.[1] If the release rates are intermittent, give the maximum release rates and times involved. Supply all pertinent supporting information, including a description of assumptions and computational methods used. Identify the physical characteristics of all radioactive effluents–particulate, ionic, gaseous, etc.

State the concentrations of all liquid effluent radionuclides prior to mixing with receiving water body (e.g., stream, lake, estuary). These concentrations should take into account dilution by plant water bodies such as cooling ponds or canals which receive effluents prior to mixing with the receiving water body. Seasonal and operational variations in dilution water usage in radwaste effluents should be stated.

Describe the orifices (high stacks or vents) from which airborne or gaseous radioactive materials are to be emitted, giving base and orifice elevations, inside diameter and shape. In cases where the height of the emitting orifice is less than 2.5 times that of surrounding buildings, supply relevant information on height, location, and shape of nearby buildings and structures. (Cross reference to Section 3.1 as appropriate). Provide data on effluent velocity, volume flow rate from the orifice, and the temperature of the effluent gases if appreciably different from ambient.

3.6 Chemical and biocide systems

Describe chemical additives (including corrosion inhibitors, chemical and biological antifouling agents), corrosion products, waste

[1] The information requested here is commonly called the "source term." The applicant's attention is directed to the set of questions in Appendix 2 of this Guide. The responses to these constitute the basic data required in calculating the source term. The set of questions may be used by the applicant as a checklist to ensure the completeness of data presented in this Section of the Report.

streams or discharges from chemical processing and water treatment that may enter the local environment as a result of plant operation. Maximum and average concentrations of chemicals and solids in any brines or cooling-system effluents should be given. Ground deposition of chemicals and solids entrained in spray fallout should be estimated. The discussion should include description of procedures by which effluents will be treated, controlled and discharged, the expected nominal and maximum concentrations for each discharge, and the quantities that will be discharged in a specified time. Seasonal and operational variations in discharges should be described. A flow diagram (which may also be combined with the liquid radwaste system) should be included.

3.7 Sanitary and other waste systems

Describe any other nonradioactive solid or liquid waste materials, such as sanitary and chemical laboratory wastes, laundry and decontamination solutions, that may be created during plant operation. Describe the manner in which they will be treated and controlled and describe procedures for disposal.

Describe any other gaseous effluents (i.e., from diesel engines, gas turbines, heating plants, incinerators) created during plant operation; estimate the frequency of release and describe how they will be treated before release to the environment.

3.8 Radioactive materials inventory

The transportation of radioactive materials has potential environmental effects (to be discussed in Section 5.3). In this Section the radioactive materials to be transported to and from the site should be described.

Describe the type of fresh fuel to be used and the quantity to be shipped to the site each year. The form of fuel, enrichment, cladding, total weight per shipment, and expected form of packaging should be discussed.

Estimate the weight of irradiated fuel to be shipped from the site per year, the number of shipments per year, the average and maximum burnup for each shipment, the cooling time required prior to each shipment, and the expected form of packaging to be used.

Estimate the annual weight, volume and activity of radioactive waste materials (e.g., spent resins and air filters) to be shipped from the site. Categorize the wastes according to whether they are liquid, solid or gaseous. Any processing that may be required before shipment, such as compacting or consolidating with vermiculite and cement, should be described.

3.9 Transmission facilities

The Environmental Report should contain sufficient information to permit evaluation of the environmental impact of transmission lines and related facilities that must be constructed to convey energy from the proposed nuclear installation to an interconnecting point or points on the existing distribution system. For material useful in preparing this subsection, the applicant is advised to consult the Department of Interior/Department of Agriculture publication entitled "Environmental Criteria for Electric Transmission Systems" (U.S. Government Printing Office, 1971) and the Federal Power Commission publication "Electric Power Transmission and the Environment."

This portion of the Report should identify and discuss parameters of possible environmental significance, including radiated electrical and acoustic noise, induced or conducted ground currents, and ozone production.

The applicant should supply contour maps and/or aerial photographs showing the proposed right-of-way and identifying any existing substation(s) or other point(s) at which the transmission line(s) will connect with the existing distribution system. The lengths and widths of the proposed rights-of-way should be specified. Any access roads, maintenance roads and new facilities located on or near the right-of-way should be shown. The applicant should indicate whether the land adjacent to the right-of-way has residential, agricultural, industrial or recreational uses. Any area where construction of the transmission line(s) will require permanent clearing of vegetation, changes in topography, or removal of manmade structures should also be indicated as well as areas where the transmission line(s) will be placed underground. Indicate the degree to which the above-ground lines will be visible from frequently traveled public roads.

Adequate descriptions of proposed line-related facilities, such as substations, should be included in the Report. This portion of the Report should provide detailed profile drawings of the various types of transmission structures, including dimensions and specifying their color and finish. The type, number and configuration of conductors and the color, number and configuration of insulators should be described and illustrated as appropriate.

4. ENVIRONMENTAL EFFECTS OF SITE PREPARATION, PLANT AND TRANSMISSION FACILITIES CONSTRUCTION

The construction of a nuclear power plant and related facilities will inevitably affect the environment; some of the effects will be adverse. Effects are considered adverse if environmental change or stress causes some biotic population or nonviable resource to be less safe, less healthy, less abundant, less productive, less aesthetically or culturally pleasing, as applicable; or if the change or stress reduces the diversity and variety of individual choice, the standard of living, or the extent of sharing of life's amenities; or if the change or stress tends to lower the quality of renewable resources or to impair the recycling of depletable resources. The severity of unavoidable adverse effects should be reduced to minimum practicable levels.

In the applicant's discussion of adverse environmental effects, it should be made clear which of these are considered unavoidable and subject to later amelioration and which are regarded as unavoidable and irreversible. Those effects which represent an irretrievable commitment of resources should receive detailed consideration in Section 4.3. (In the context of this discussion, "irretrievable commitment of resources" alludes to natural sources and means a permanent impairment of these, e.g., loss of wildlife habitat; destruction of nesting, breeding or nursing areas; interference with migratory routes; loss of valuable or aesthetically treasured natural areas; as well as expenditure of directly utilized resources.)

4.1 Site preparation and plant construction

The applicant should organize the discussion in terms of the effects of site preparation and plant construction on (a) land use and (b) water use. The applicant should consider consequences to both human and wildlife populations and indicate which are unavoidable, reversible, etc. according to the categorization set forth earlier in this Section.

In the land use discussion, describe how construction activities may disturb the existing terrain and wildlife habitats. Consider the effects of such activities as creating building material supply areas; building temporary or permanent roads, bridges, service lines; disposing of trash, excavating and land filling. Provide information bearing on such questions as: How much land will be torn up? For how long? Will there be dust or smoke problems? What explosives will be used? Where and how often? Indicate proximity of human populations and identify undesirable impacts on their environment arising from noise, from inconvenience due to the movement of men, material, machines, including activities associated with any provision of housing, transportation, educational facilities for workers and their families. Describe any expected changes in accessibility of historical and archaeological sites in the region. Discuss measures designed to mitigate or reverse undesirable effects, such as erosion control, dust stabilization, landscape restoration, control of truck traffic, restoration of affected animal habitat.

The discussion should also include any effects of site preparation and plant construction activities whose consequences may be beneficial to the region, as, for example, the use of spoil to create playgrounds and/or recreational facilities.

The discussion of water use should describe the impingement of site preparation and construction activities on regional water (lakes, streams, ground water, etc.). Such activities would include the construction of cofferdams, and/or storm sewers, dredging operations, placement of fill material in the water, and the creation of shoreside facilities involving bulkheads, piers, jetties, basins or other structures enabling ingress or egress from the plant by water. Examples of other pertinent activities are the construction of intake and discharge structures for cooling water or other purposes, straightening or deepening a water channel and operations affecting water levels (flooding), etc. The applicant should describe the effects of these activities on navigation, fish and wildlife resources, water quality, water supply, aesthetics and so on as applicable. Measures to mitigate undesirable effects, such as flood and pollution control, installation of fish ladders or elevators and other procedures for habitat improvement should be described.

4.2 Transmission facilities construction

The effects of construction and installation of transmission line towers and facilities on the land and on the people, including those living in and those visiting or traveling through the adjacent area, should be discussed in this Section. (Refer to Section 3.9 for the basic information.)

The following topics may serve as guidelines for this discussion but the applicant should include additional material if it is relevant:

a) Any permanent changes that will be induced in the physical and biological processes of plant and wild life through the changes in the hydrology, topography or ground cover during construction and installation of the transmission lines.
b) Total length of new lines and number of towers through and in various categories of visually sensitive land (that is sensitive to presence of transmission lines and towers) such as natural shoreline, marshland, wildlife refuges, parks, national and state monuments, scenic areas, recreation areas, historic areas, national forests and/or heavily timbered areas, shelter belts, steep slopes, wilderness areas.
c) Number and length of new access and service roads required.
d) Erosion directly traceable to construction activities.
e) Plans for protection of wildlife, for disposal of slash and unmerchantable timber, and for cleanup and restoration of area affected by clearing and construction activities.

4.3 Resources committed

Discuss any irreversible and irretrievable commitments of resources (loss of land, destruction of biota, etc.) which are expected should site preparation and plant and transmission facilities construction proceed. Such losses should be evaluated in terms of their relative and long term net, as well as absolute, impacts. (See Section 5.8 of this Guide for more detailed consideration.)

5. ENVIRONMENTAL EFFECTS OF PLANT OPERATION

This Section describes the interaction of the plant (discussed in Section 3) and the environment (discussed in Section 2). To the extent possible, the applicant should avoid repeating the material presented in Sections 2 and 3. Measures planned to reduce any undesirable effect of plant operation on the environment should be described in detail.

In the discussion of environmental effects, as in Section 4, effects that are considered unavoidable but either inherently temporary or subject to later amelioration should be clearly distinguished from those regarded as unavoidable and irreversible. Those effects which represent an irretrievable commitment of resources should receive detailed consideration in Section 5.8.

The impacts of operation of the proposed facility should be, to the fullest extent practicable, quantified and systematically presented.[1] In the discussion of each impact, the applicant should make clear whether the supporting evidence is based on theoretical, laboratory, on-site, or field studies undertaken on this or on previous occasions. The source of each impact—the plant subsystem, waste effluent—and the population or resource affected should be made clear in each case The impacts should be distinguished in terms of their effects on surface water bodies, ground water, air, and land.

Finally, as directed by the Guidelines of the Council on Environmental Quality (36 F.R. 7724, April 23, 1971), the applicant should discuss the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. In accordance with this directive, the applicant should assess the action for cumulative and long-term effects from the point of view that each generation is trustee of the environment for each succeeding generation. This means considering, for example, the commitment of a water source to use as a cooling medium in terms of impairment of other actual or potential uses, and any other long-term effects to which the operation of this facility may contribute.

5.1 Effects of operation of heat dissipation system

Waste heat, dissipated by the system described in Section 3.4, alters the thermal conditions of the environment. In all cases the heat is eventually transferred to the atmosphere.

Since the transfer is usually effected through the surface of a river, pond, lake, estuary or ocean or by the evaporation of water in a cooling tower, the hydrology of the

[1] Quantification of environmental costs is discussed in Section 10.

environment (Section 2.5) and the aquatic ecology (Section 2.7) are of primary importance in determining what effects the released heat will have on the environment.

Describe the effect that the heated effluent will have on the temperature of the receiving body of water with respect to space and time. Describe changes in temperature caused by drawing water from one depth and discharging it at another. The predicted characteristics of the mixing zone and temperature changes in the receiving body of water as a whole should be covered. Include seasonal effects. Discuss any model studies that have been performed to determine these characteristics, giving references to reports that provide supporting details. Indicate whether the discharge could affect the quality of the waters of any other State or States.

Describe the thermal standards applicable to the water source (including maximum permissible temperature, maximum permissible increase, mixing zones, and maximum rates of increase and decrease) and whether, and to what extent, these standards have been approved by the Administrator of the Environmental Protection Agency in accordance with the Federal Water Pollution Control Act, as amended.

Describe the effects of released heat on marine and fresh-water life. Give basis for prediction of effects. In this discussion, appropriate references to the baseline ecological data presented in Section 2.7 should be made. Expected thermal effects should be related to the optimum and tolerance temperature ranges for important (as defined in Section 2.7) aquatic species and the food base which supports them. The evaluation should consider not only the mixing zone, but the entire regional aquatic habitat potentially affected by operation of the proposed plant.

Potential hazards of the cooling water intake and discharge structures (described in Section 3.4) to fish species and food base organisms should be identified and steps planned to measure and minimize the hazards should be discussed. Diversion techniques should be discussed in light of information obtained from ecological studies on fish population, size, and habitats.

The effects of passage through the condenser on zooplankton, phytoplankton, meroplankton, and small nektonic forms such as immature fish and the resultant implications for the important species and functional groups should be discussed.

The applicant should discuss the potential biological effects of modifying the natural circulation of the water body, especially where water is withdrawn from one region or zone and discharged into another. This includes such factors as dissolved oxygen, nutrients, scouring, and suspended sediments.

Plant-induced changes in the temperature of the discharged water subsequent to environmental stabilization, can affect aquatic life in the receiving body. Accordingly, the applicant should discuss the possible effects of reactor shutdown (and other temporary related conditions) including the dependence of effects on the season in which shutdown occurs. An estimate of the number of scheduled and unscheduled shutdowns per year should be given. Refueling schedules should be indicated, particularly where temperature cycling in the receiving waters is likely to be large (e.g., refueling in winter). Discuss steps to be taken to mitigate the effects of shutdown.

Discuss the expected environmental effects, if any, of heat dissipation facilities such as cooling towers, lakes, spray ponds, or techniques such as dilution with additional water or diffuser systems on the local environment and on agriculture, housing, highway safety, airports, or other facilities with respect to meteorological phenomena including fog or icing, cooling tower blowdown and drift, noise. If fog or icing may occur, the estimated hours per year, distances, directions, and transportation arteries potentially affected should be presented. Consider possible synergistic effects that might result from mixing with other effluents in the atmosphere. (Environmental effects of chemicals discharged from cooling tower blowdown and drift should be discussed in Section 5.4).

5.2 Radiological impact on biota other than man

In this Section the applicant should consider the impact on biota other than man attributable to the release of radioactive materials from the facility. Specifically, the discussion should include an estimate of typical maximum dose rates (rad/year) for species of local flora and local and migratory fauna considered to be "important" as defined in Section 2.7.

5.2.1 Exposure pathways

The various possible pathways for radiation exposure of the important local flora and local and migratory fauna should be identified and described in textual and flowchart format. (An example of an exposure pathway chart is given in Appendix 3.) The pathways should include the important routes of radionuclide translocation (including food chains leading to important species) to organisms or sites.

5.2.2 Radioactivity in environment

In Section 3.5, the radionuclide concentrations in the liquid and gaseous effluents from the facility are listed. In this Section, the applicant should consider how these effluents are quantitatively distributed in the environment. Specifically, estimates should be provided for the radionuclide concentrations in any surface waters (including the water that receives any liquid radioactive effluents), on land areas, and on vegetation (on a per unit area basis) in the environs. If there are other components of the physical environment that may become contaminated and thus cause the exposure of living organisms to nuclear radiations, they should be identified and their radioactivity burden estimated. In addition, information concerning any cumulative buildup of radionuclides in the environment, such as in sediments, should be presented and discussed.

5.2.3 Dose rate estimates

From considerations of the exposure pathways and the distribution of facility-derived radioactivity in the environs, the applicant should estimate the maximum radionuclide concentrations that may be present in important local flora and local and migratory fauna and the resultant dose rates (rad/year). Values of bioaccumulation factors[2] used in preparing the estimates should be based on site-specific data if available; otherwise, values from the literature may be used. The applicant should tabulate and reference the values of bioaccumulation factors used in the calculations.

Since the region may contain many important species, the applicant should limit the calculations to estimating the dose rates experienced by selected species (indicator organisms) from habitats (terrestrial and/or aqueous) having the highest potential for radiation exposure.

5.3 Radiological impact on man

In this Section the applicant should consider the radiological effects of facility operation and transportation of radioactive materials on man. Estimates of the radiological impact on man via various exposure pathways should be provided.

5.3.1 Exposure pathways

The various possible pathways for radiation exposure of man should be identified and described in textual and flowchart format. (An example of an exposure pathway chart is given in Appendix 3.) As a minimum, the following pathways should be evaluated: drinking; swimming; fishing; eating fish, invertebrates, and plants.

5.3.2 Liquid effluents

Estimate the expected annual average concentrations of radioactive nuclides (listed in Section 3.5) in receiving water at locations where water is consumed or otherwise used by human beings or where it is inhabited by biota of significance to human food chains. (If discharges are intermittent, concentration peaks as well as annual averages should be estimated.) Specify the dilution factors used in preparing the estimates and the locations where the dilution factors are applicable.

Provide data on recreational and similar use of receiving water and its shoreline, e.g., swimming, fishing, picnicking, hunting, clam digging. Include any persons who derive the major parts of their incomes from water adjacent to the site and indicate the amount of time spent per year in this activity.

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[2] The bioaccumulation factor is the equilibrium ratio: (concentration in organism)/(concentration in water). Values of bioaccumulation factors can be obtained from such references as:

W. H. Chapman, H. L. Fisher, M. W. Pratt, "Concentration factors of chemical elements in edible aquatic organisms", University of California Radiation Laboratory report UCRL- 50564 (December 30, 1968).

A. M. Freke, "A Model for the Approximate Calculation of Safe Rates of Discharge of Radioactive Wastes Into Marine Environments" *Health Physics, 13,* 734 (1967).

Data on irrigation usage of the receiving water should be included, such as the number of acres irrigated, points at which irrigation water is drawn (downstream from the site), what type(s) of crops are produced within 50 miles of the site and the yield of each crop per acre.

Provide data on the commercial fish and seafood catch (number of pounds per year of each species within the region). Include any harvest and usage of seaweed or other aquatic plant life.

Determine the expected radionuclide concentrations in aquatic and terrestrial organisms significant to human food chains. Use the bioaccumulation factors given in Section 5.2.3 or supply others as necessary.

Calculate the following, using the above information and any other necessary supporting data (provide details and models of the calculation as an appendix):

Total body and significant organ doses (rem/year) to individuals in the population from all receiving water-related exposure pathways, i.e., all sources of internal and external exposure.

5.3.3 Gaseous effluents

From release rates of radioactive gases and meteorological data (Sections 3.5 and 2.6, respectively), estimate total body and significant organ doses (rem/year) to individuals exposed at the point of maximum ground-level concentrations off-site. Assume annual average meteorological conditions for a BWR and limiting meteorological conditions for a PWR. Identify locations of points of release (stack, roof vent, etc.) used in calculations.

Estimate deposition of radioactive halogens and particulates on food crops and pasture grass. Consider maximum ground-level deposition on pasture grass, even though milk cows may not be grazing there at the present time. Estimate total body and thyroid doses (rem/year) and significant doses received by other organs via such potential pathways (include, in particular, the air-grass-milk pathway).

Provide an appendix describing the models used in these calculations.

5.3.4 Direct radiation

5.3.4.1 Radiation from facility

The applicant should provide an estimate of the total external dose (rem/year) and the total population external dose (man-rem/year) received by individuals outside the facility from direct radiation, e.g., gamma radiation emitted by turbines and radioactive waste vessels. In particular, the applicant should estimate the expected external dose rates received by individuals in nearby schools, hospitals, or other publicly used facilities.

5.3.4.2 Transportation of radioactive materials

Radioactive materials to be shipped to and from the plant during its operation have been identified and described in Section 3.8. In this Section the direct radiation exposure of man attributable to the transportation of these materials should be estimated.

The applicant should identify the supplier of the fresh fuel and the most likely route to be taken by the carrier from the point of supply to the plant. The distance, most likely mode of transport and details of shipment should be described. The latter discussion should include information on the number of fuel elements per package, number of packages per vehicle (truck, barge, railroad car) and the probable number of shipments per year. The applicant should estimate the radiological dosage, if any, to drivers, helpers and population along the transport route.

Similar information concerning shipments of irradiated fuel should be supplied by the applicant. In connection with the description of shipment details, the applicant should indicate the method of in-transit cooling and the methods used to contain leaking fuel assemblies. The applicant should estimate the radiological doses in man-rem per trip and per year to drivers, helpers and population along the transport route.

For other radioactive wastes to be shipped from the plant, the applicant should identify the disposal site and its distance from the plant, the most likely route of transport, mode of transport as well as the type of packaging, the number, weight and activities of packages to be shipped each year. The applicant should estimate the radiological doses in man-rem per trip and per year to driver, helpers and population along the transport route.

5.3.5 Other exposure pathways

Provide estimates of individual total body doses (rem/year) and population total body doses (man-rem/year) that could be received via pathways other than those previously discussed. Discuss any exposure pathways, if they exist, involving radionuclides accumulated in sediments or in other components of the environment. (See Section 5.2.2.)

5.3.6 Summary of annual radiation doses

The applicant should present a table that summarizes the estimated radiation dose to the regional population from all plant-related sources using values calculated in previous Sections. The tabulation should include (a) the total body doses to the population (man-rem/year) from all receiving water-related pathways and (b) the total body doses to the population (man-rem/year) attributable to gaseous effluents out to a distance at least of 50 miles from the site.

5.4 Effects of chemical and biocide discharges

Chemical and biocide discharges have been described in Section 3.6. Water resources and use are discussed in Sections 2.5 and 3.3. In this Section, the specific concentrations of these wastes at the points of discharge should be compared with natural ambient concentrations without the discharge and also compared with applicable water standards. The projected effects of the effluents for both acute and chronic exposure of the biota (including any long-term buildup in sediments and in the biota) should be identified and discussed. Dilution and mixing of discharges into the receiving waters should be discussed in detail and estimates of concentrations at various distances from the point of discharge should be provided. The effects on terrestrial and aquatic environments from chemical wastes which contaminate ground water should be included.

The effects of chemicals in cooling tower blowdown and drift on the environment should also be considered in this Section.

5.5 Effects of sanitary and other waste discharges

Sanitary and other waste systems have been described in Section 3.7. Treat the expected discharges as in Section 5.4.

5.6 Effects of operation and maintenance of the transmission system

The environmental effects of operation and maintenance of the transmission system required to tie in the proposed facility to the pre-existing network must be evaluated. The evaluation of effects should make clear the applicant's plans for maintenance of the right-of-way and required access roads. Plans for use of herbicides and pesticides should indicate types, volume, concentrations, and manner and frequency of use. Resulting effects on plant life, wildlife habitat, land resources, and scenic values should be evaluated.

This Section of the Report should also reference the applicant's estimate of any electrical effects of potential environmental significance which were previously identified and discussed in Section 3.9.

5.7 Other effects

The applicant should discuss any effects of plant operation that do not clearly fall under any single topic of Sections 5.1 to 5.6. These may include changes in land and water use at the plant site, interaction of the plant with other neighboring plants, and disposal of solid and liquid wastes other than those discussed in Sections 5.3 through 5.5.

5.8 Resources committed

Discuss any irreversible and irretrievable commitments of resources due to plant operation. This discussion should include both direct commitments, such as depletion of uranium resources, and irreversible environmental losses, such as destruction of wildlife habitat.

In this discussion the applicant should consider lost resources from the viewpoints of both relative impacts and long-term net effects. As an example of relative impact assessment, the loss of two thousand fish of a given species could represent quite different degrees of significance, depending on the total population in the immediate region. Such a loss however, in the case of a small local population, could be less serious if the same species were abundant in neighboring regions. Similarly, the loss of a given area of highly desirable land should be evaluated in terms of the total amount of such land in the environs. These relative assessments should accordingly 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 in the immediate region is related to that in surrounding regions. The latter should be specified in terms of areas and distances from the site.

In evaluating long-term effects for their net consequences, the applicant may consider, as an example, the impact of thermal and chemical discharges on fish. There may be severe losses in the local discharge area. However, the slight temperature elevation of neighboring regions of the water body, together with possible synergistic effects of diluted chemical discharges, may augment the spawning rate. In such a case the local population change may or may not be a net loss. Therefore, changes in population of important species, caused by, or expected to be caused by, the operation of the plant should be examined with the view of determining whether they represent long-term net losses or long-term net gains. The considerations are also applicable to Sections 9 and 10 of the Report.

6. EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

The purposes of this Section are to describe in detail the means by which the applicant collected the baseline data presented in other Sections and to describe the applicant's plans and programs for monitoring the environmental impacts of site preparation, plant construction and operation.

Section 6.1 is addressed to the measurement of pre-existing characteristics of the site and the surrounding region. This program will establish a reference framework for assessing subsequent environmental effects attributable to the activity. The applicant's attention is directed to two considerations pertinent to this Section. First, the term "pre-existing" means, in all cases, at least pre-operational. A given characteristic or parameter may or may not require assessment prior to site preparation and plant construction, depending on whether that particular characteristic may be altered at these stages. Second, in most instances this Guide indicates the specific environmental effects to be evaluated; consequently, the parameters to be measured will be apparent. In some cases, it may be necessary for the applicant to establish a monitoring program based on his own identification of potential or possible effects and to provide his underlying rationale for such. Accordingly, the applicant should carefully review the plans for measurement of pre-existing conditions to ensure that these plans include all factors which must be subsequently monitored during plant operation, as discussed in Section 6.2.

Sampling design, frequency, methodology (including calibration and checks with standards) and instrumentation for both collection and analysis are to be discussed and justified as applicable. Information should be provided on instrument sensitivity and, especially for highly automated systems, reliability.

6.1 Applicant's pre-operational environmental programs

The programs for collection of environmental data prior to operation should be described in sufficient detail to make it clear that the applicant has established a thorough and comprehensive approach to environmental assessment. The description of these programs should be confined principally to technical descriptions of instrumentation, technique, and procedures. Organizational aspects such as scheduling or validation are relevant only as they may bear upon technical program characteristics.

Where information from the literature has been used by the applicant, it should be concisely summarized and documented by reference to original data sources. Where the availability of original sources that support important conclusions is limited, the applicant should provide either extensive quotations or references to accessible secondary sources.[1] In all cases, information derived from published results should be clearly distinguished from information derived from the applicant's field measurements.

[1] Any reports of work (e.g., ecological surveys) supported by the applicant that are of significant value in assessing the environmental impact of the proposed action should be included as appendices or supplements to the Environmental Report, unless the reports are otherwise generally available.

6.1.1 Surface waters

When a body of surface water may be affected by the proposed facility or a practicable alternative, the applicant should describe the programs by which the background condition of the water and the related ecology were determined. In cases where a natural water body has already been subjected to environmental stress from pollutant sources, the nature of this stress and its consequences should be evaluated. The applicant should then estimate the potential quality of the affected water body, assuming removal of the existing pollutant sources; knowledge of this quality level will permit evaluation of any adverse effect of the proposed facility.

6.1.1.1 Physical and chemical parameters

The programs and methods for measuring physical and chemical parameters of potentially affected surface waters should be described. The sampling program should be presented in sufficient detail to demonstrate its adequacy with respect both to spatial coverage (surface area and depth) and to temporal coverage (duration and sampling frequency), giving due consideration to seasonal changes in effluent. This description of data collection programs should include methods used in determining the pre-existing condition of the surface waters with respect to any parameters which might change as a result of plant operation. This discussion should include a description of the techniques used to identify any condition that might lead to interactions with plant discharges, for example, the presence of impurities in a water body which may react synergistically with heated effluent.

In addition to describing the programs for obtaining the data, the applicant should also describe the computational models used in predicting effects. The applicant should indicate how the models were verified and calibrated.

6.1.1.2 Ecological parameters

The applicant should describe the preoperational program used to assess the ecological characteristics identified in Section 2.7. Those portions of the program concerned with determining the presence and abundance of species should be detailed in terms of frequency, pattern and duration of observation. The applicant should describe how taxonomic determinations were made and validated. In this connection, the applicant should discuss its reference collection of voucher specimens or other means whereby consistent identification will be assured.

Describe the methods used or to be used for observing natural variations of ecological parameters. If these methods will involve indicator organisms, the criteria for their selection should be presented.

The applicant should discuss the rationale for predicting which non-lethal physiological and behavioral responses of important species may be affected because of construction and operation of the facility. This discussion should be appropriately correlated with the description of the monitoring program.

Sources of parameters of lethality for organisms potentially affected by plant discharges should be identified. The methodology for determining such parameters should be reviewed with respect to applicability to actual local conditions to be anticipated during operation, including interactive effects among multiple effluents and existing constituents of the surface water body concerned.

6.1.2 Ground water

In those cases in which the proposed facility or a practicable design alternative may potentially affect local ground water, the program leading to assessment of potential effects should be described.

6.1.2.1 Physical and chemical parameters

The properties and configuration of the local aquifer will have been defined in sufficient detail (in Section 2.5) to permit a reasonable projection of effects of plant operation on the

ground water. Methods for obtaining information on ground water levels and ground water quality should be described.

6.1.2.2 Models

Models may be used to predict effects, such as changes in ground water levels, dispersion of contaminants, and eventual transport through aquifers to surface water bodies. The models should be described and supporting evidence for their reliability and validity presented.

6.1.3 Air

The applicant should describe the program for obtaining information on local air quality, if relevant, and local meteorology. The description should show the basis for predicting such effects as the dispersion of gaseous effluents and alteration of local climate (e.g., fogging and icing) as well as present the methodology for gathering baseline data.

6.1.3.1 Meteorology

The applicant should identify sources of meteorological data relevant to such effects as the dispersion of water vapor, dissolved solids and particulates carried by droplets. Locations of observation stations, instrumentation, and frequency and duration of measurements should be specified both for the applicant's measuring activities and for activities of governmental agencies or other organizations on whose information the applicant intends to rely.

6.1.3.2 Models

Any models used by the applicant either to derive estimates of basic meteorological information or to estimate the effects of effluent systems should be described and their validity and accuracy discussed.

6.1.4 Land

Data collection programs concerning the terrestrial environment of the proposed facility should be described and justified with regard to both scope and methodology.

6.1.4.1 Geology and soils

Geological studies conducted in support of safety analyses should be briefly summarized and reference made to the relevant safety reports for a more detailed presentation. The applicant should describe the collection of data on any soil conditions that may be altered by plant construction and operation. The description should include identification of the sampling pattern and the justification for its selection, the sampling method, holding periods and pre-analysis treatment, and analytic techniques.

6.1.4.2 Land use and demographic surveys

The applicant should describe his program for identifying the actual land use in the site environs and for acquiring demographic data for the region.

Sources of information should be identified and their accuracy assessed. Methods used to forecast from data should be described.

6.1.4.3 Ecological parameters

In this Section the applicant should discuss the program used to assess the ecological characteristics of the site with primary reference to important terrestrial biota. In general, the considerations involved are similar to those suggested in connection with aquatic biota (Section 6.1.1.2). However, the difference in habitat, differences in animal physiology and other pertinent factors will, of necessity, influence the design of the assessment program. The applicant should present, as in Section 6.1.1.2, an analysis of the program in terms of taxonomic validation, rationale for its predictive aspects and the details of its methodology.

6.1.5 Radiological surveys

This Section of the Environmental Report should discuss the methods used to determine the pre-operational radiation levels at the site and environs and the

concentrations of any radioactive materials occurring in important local and regional biota, as well as in soil, rocks and surface waters (see Section 2.8).

The methods used should be thoroughly described and documented. The discussion should include identification of sampling or collection sites, sampling methods, duration and frequency, and analytical procedures (including pre-analysis treatment, instrumentation and minimum sensitivities) as applicable.

6.2 Applicant's proposed operational monitoring programs

The applicant should present the proposed operational monitoring program for the facility. Review of this description will be facilitated if the applicant includes maps of observation sites and tabular presentation of summary descriptors of such factors as frequency, type of sampling, method of collection, analytic method, holding times and pre-analysis treatment, instrumentation, and minimum sensitivities. The program description should be explicit with respect to the parameter limits that are not to be exceeded under normal operating conditions and with regard to the actions planned in the event the limits are exceeded.

6.2.1 Radiological monitoring

The applicant's operational monitoring program for radiological effects should be described both for the plant monitoring system and the environmental monitoring program.

6.2.1.1 Plant monitoring system

Describe, in general, in-plant monitoring systems for radioactive liquid and gaseous effluents. Discuss the sensitivity limits for detecting radioactivity corresponding to routinely expected release rates. List the effluent streams, if any, that will not be monitored and provide brief rationale for the absence of monitoring.

6.2.1.2 Environmental radiological monitoring

The operational surveillance program should be described in detail, with specific attention given to the types of samples to be collected, sampling locations and frequency, and the analyses to be performed on each sample. The analytical sensitivity (detection threshold) for each analysis and the schedule for reporting data collected from the surveillance program should be discussed.

6.2.2 Chemical effluent monitoring

The proposed measurement program, including instrumentation, locations and frequencies, and analytical techniques, should be fully described. The description of the program should include instrumentation sensitivity and, particularly in the case of automated systems, reliability. Monitoring procedures prescribed by local, State, or Federal agencies as conditions placed upon operation should be so identified.

The criteria for setting threshold levels for corrective action should be presented. In the case of prescribed quantitative standards set by agencies, the applicable regulation should be cited. In the case of quantitative limits set by the applicant to conform to qualitative standards or restrictions, the applicant's rationale should be presented. In either case, the action to be taken if measurements exceed thresholds should be specified.

If the program for monitoring chemical effluents does not include monitoring substances which are naturally present in the intake water and are routinely discharged from the facility, the bases for these omissions should be verified.

6.2.3 Thermal effluent monitoring

The proposed program for monitoring thermal effluents should be described and sampling sites located on maps or diagrams. Sampling procedures, schedules, and instrumentation sensitivity and reliability should be described.

Applicable water quality standards should be cited. It should be made clear how conformance to such standards is verified. In particular, if conformance is inferred by extrapolation from measurements using a computational model, the validity of the

model should be reviewed. The applicant should present the criteria used to determine the action to be taken when surveillance indicates non-conformance; the specific remedial actions should be identified.

Obligations for reporting results should be stated and schedules presented.

6.2.4 Meteorological monitoring

The applicant's program for monitoring meteorological phenomena should be described. In cases where possible fogging and icing in the environs are predicted, the quantitative levels of the phenomena to be observed should be specified. The applicant should describe plans for compiling data, verifying models, and accumulating results useful in planning other facilities. Means by which the meteorological effects of plant operation can be isolated from natural meteorological phenomena should be described. (This may include correlation of data with observations made at a site nearby, but out of range of significant effects originating within the site.) The applicant should indicate the action planned to mitigate adverse effects (e.g., highway icing) in the event a real hazard develops.

6.2.5 Ecological monitoring

In the pre-operational surveillance program the applicant will have established methodology for determining the ecological characteristics of the region. In principle, this methodology should be appropriate for the subsequent monitoring program to be maintained during plant operation. However, the applicant may choose to modify some aspects of his methodology in view of the requirement for protracted monitoring. Such aspects, may include frequency, observation sites and so forth. These should be described and justified. Also, the applicant should, in this Section, indicate how changes in the physiological and behavioral characteristics of the observed biota will be ascribed either to specific effects of plant operation or to natural variation.

6.3 Related environmental measurement and monitoring programs

When the applicant's site lies within a region for which environmental measurement and/or monitoring programs are carried out by public or other agencies not directly supported by the applicant, these programs should be identified and discussed. Relevance of such independent findings to the proposed facility's effects should be described and plans for exchange of information should be presented. Agencies responsible for the programs should be identified and, to the extent possible, the procedures and methodologies employed should be described in the same manner as for the applicant's own programs.

7. ENVIRONMENTAL EFFECTS OF ACCIDENTS

The applicant should discuss the environmental effects of possible accidents which may occur within the plant or during transportation of radioactive materials.

7.1 Plant accidents[1]

Postulated accidents are discussed in another context in applicant's safety analysis reports. The principal line of defense is accident prevention through correct design, manufacture, and operation, and a quality assurance program is used to provide and maintain the necessary high integrity of the reactor system. Deviations that may occur are handled by protective systems to place and hold the plant in a safe condition. Notwithstanding all this, the conservative postulate is made that serious accidents might occur, in spite of the fact that they are extremely unlikely, and engineered safety features are installed to mitigate the consequences of these unlikely postulated events.

In the consideration of the environmental risks associated with the postulated accidents, the probabilities of their occurrence and their consequences must both be taken into account. Since it is not practicable to consider all possible accidents, the spectrum of accidents, ranging in severity from trivial to very serious, is divided into classes.

Each class can be characterized by an occurrence rate and a set of consequences.

Standardized examples of classes of accidents to be considered by applicants in preparing the

[1] The text of this Section was published in 36 F.R. 22851-22854, December 1, 1971.

section of Environmental Reports dealing with accidents are set out in tabular form below. The spectrum of accidents, from the most trivial to the most severe, is divided into nine classes, some of which have subclasses. The accidents stated in each of the first eight classes tabulated below are representative of the types of accidents that must be analyzed by the applicant in Environmental Reports; however, other accident assumptions may be more suitable for individual cases. Where assumptions as not specified, or where those specified are deemed unsuitable, assumptions as realistic as the state of knowledge permits shall be used, taking into account the specific design and operational characteristics of the plant under consideration.

For each class, except Class 1 and 9, the environmental consequences shall be evaluated as indicated. Those classes of accidents, other than Classes 1 and 9, found to have significant adverse environmental effects shall be evaluated as to probability, or frequency of occurrence, to permit estimates to be made of environmental risk or cost arising from accidents of the given class.

Class 1 events need not be considered because of their trivial consequences.

Class 8 events are those considered in safety analysis reports and AEC staff safety evaluations. They are used, together with highly conservative assumptions, as the design-basis events to establish the performance requirements of engineered safety features. The highly conservative assumptions and calculations used in AEC safety evaluations are not suitable for environmental risk evaluation, because their use would result in a substantial overestimate of the environmental risk. For this reason, Class 8 events shall be evaluated realistically. Consequences predicted in this way will be far less severe than those given for the same events in safety analysis reports where more conservative evaluations are used.

The occurrences in Class 9 involve sequences of postulated successive failures more severe than those postulated for the design basis for protective systems and engineered safety features. Their consequences could be severe. However, the probability of their occurrence is so small that their environmental risk is extremely low. Defense in depth (multiple physical barriers), quality assurance for design, manufacture, and operation, continued surveillance and testing, and conservative design are all applied to provide and maintain the required high degree of assurance that potential accidents in this class are, and will remain, sufficiently remote in probability that the environmental risk is extremely low. For these reasons, it is not necessary to discuss such events in the Environmental Report.

Furthermore, it is not necessary to take into account those Class 8 accidents for which the applicant can demonstrate that the probability has been reduced and thereby the calculated risk to the environment made equivalent to that which might be hypothesized for a Class 9 event.

The applicant may substitute other accident class breakdowns and alternative values of radioactive material releases and analytical assumptions, if such substitution is justified in the Environmental Report.

ACCIDENT ASSUMPTIONS

ACCIDENT–1.0 Trivial Incidents

These incidents shall be included and evaluated under routine releases in accordance with proposed Appendix I of 10 CFR Part 50 [See Appendix 4 of this Guide].

ACCIDENT–2.0 Small Release Outside Containment

These releases shall include such things as releases through steamline relief valves and small spills and leaks of radioactive materials outside containment. These releases shall be included and evaluated under routine releases in accordance with proposed Appendix I of 10 CFR Part 50. [See Appendix 4 of this Guide.]

ACCIDENT–3.0 Radwaste System Failure

3.1 **Equipment leakage or malfunction** (Includes operator error)
- (a) Radioactive gases and liquids: 25% of average inventory in the larges storage tank shall be assumed to be released.
- (b) Meteorology assumptions: χ/Q values are to be 1/10 of those given in AEC Safety Guide No. 3 or 4[2].

[2] Copies of these Guide(s), dated November 2, 1970, are available at the Commission's Public Document Room, 1717 H Street, N. W. Washington, D.C. and on request to the Director, Division of Reactor Standards, U.S. Atomic Energy Commission, Washington, D.C. 20545.

(c) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

3.2 Release of waste gas storage tank contents (Includes failure of release valve and rupture disks)

(a) 100% of the average tank inventory shall be assumed to be released.

(b) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.

(c) Consequences should be calculated by weighting the effects in different directions by the frequency of the wind blows in each direction.

3.3 Release of liquid waste storage tank contents

(a) Radioactive liquids: 100% of the average storage tank inventory shall be assumed to be spilled on the floor of the building.

(b) Building structure shall be assumed to remain intact.

(c) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.

(d) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

ACCIDENT–4.0 Fission Products to Primary System (BWR)

4.1 Fuel cladding defects

Release from these events shall be included and evaluated under routine releases in accordance with proposed Appendix I of 10 CFR Part 50. [See Appendix 4 of this Guide.]

4.2 Off-design transients that induce fuel failures above those expected (Such as flow blockage and flux maldistributions)

(a) 0.02% of the core inventory of noble gases and 0.02% of the core inventory of halogens shall be assumed to be released into the reactor coolant.

(b) 1% of the halogens in the reactor coolant shall be assumed to be released into the steam.

(c) The mechanical vacuum pump shall be assumed to be automatically isolated by a high radiation signal of the steam line.

(d) Radioactivity shall be assumed to carry over to the condenser where 10% of the halogens shall be assumed to be available for leakage from the condenser to the environment at 0.5%/day for the course of the accident (24 horus).

(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3.

(f) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

ACCIDENT–5.0 Fission Products to Primary and Secondary Systems (Pressurized Water Reactor)

5.1 Fuel cladding defects and steam generator leak

Release from these events shall be included and evaluated under routine releases in accordance with proposed Appendix I of 10 CFR Part 50. [See Appendix 4 of this Guide.]

5.2 Off-design transients that induce fuel failure above those expected and steam generator leak (such as flow blockage and flux maldistributions)

(a) 0.02% of the core inventory of noble gases and 0.02% of the core inventory and halogens shall be assumed to be released into the reactor coolant.

(b) Average inventory in the primary system prior to the transient shall be based on operation with 0.5% failed fuel.

(c) Secondary system equilibrium radioactivity prior to the transient shall be based on a 20 gal/day steam generator leak and a 10 gpm blowdown rate.

(d) All noble gases and 0.1% of the halogens in the steam reaching the condenser shall be assumed to be released by the condenser air ejector.

(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 4.

(f) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

5.3 Steam generator tube rupture

(a) 15% of the average inventory of noble gases and halogens in the primary

coolant shall be assumed to be released into the secondary coolant. The average primary coolant activity shall be based on 0.5% failed fuel.

(b) Equilibrium radioactivity prior to rupture shall be based on a 20 gallon per day steam generator leak and a 10 gpm blowdown rate.

(c) All noble gases and 0.1% of the halogens in the steam reaching the condenser shall be assumed to be released by the condenser air ejector.

(d) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 4.

(e) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

ACCIDENT–6.0 Refueling Accidents

6.1 Fuel bundle drop

(a) The gap activity (noble gases and halogens) in one row of fuel pins shall be assumed to be released into the water. (Gap activity is 1% of total activity in a pin).

(b) One week decay time before the accident occurs shall be assumed.

(c) Iodine decontamination factor in water shall be 500.

(d) Charcoal filter efficiency for iodines shall be 99%.

(e) A realistic fraction of the containment volume shall be assumed to leak to the atmosphere prior to isolating the containment.

(f) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.

(g) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

6.2 Heavy object drop onto fuel in core

(a) The gap activity (noble gases and halogens) in one average fuel assembly shall be assumed to be released into the water. (Gap activity shall be 1% of total activity in a pin).

(b) 100 hours of decay time before object is dropped shall be assumed.

(c) Iodine decontamination factor in water shall be 500.

(d) Charcoal filter efficiency for iodines shall be 99%

(e) A realistic fraction of the containment volume shall be assumed to leak to the atmosphere prior to isolating the containment.

(f) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.

(g) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

ACCIDENT–7.0 Spent Fuel Handling Accident

7.1 Fuel assembly drop in fuel storage pool

(a) The gap activity (noble gases and halogens) in one row of fuel pins shall be assumed to be released into the water. (Gap activity shall be 1% of total activity in a pin).

(b) One week decay time before accident occurs shall be assumed.

(c) Iodine decontamination factor in water shall be 500.

(d) Charcoal filter efficiency for iodines shall be 99%.

(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.

(f) Consequences shall be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

7.2 Heavy object drop onto fuel rack

(a) The gap activity (noble gases and halogens) in one average fuel assembly shall be assumed to be released into the water. (Gap activity is 1% of total activity in a pin).

(b) 30 days decay time before the accident occurs shall be assumed.

(c) Iodine decontamination factor in water shall be 500.

(d) Charcoal filter efficiency for iodines shall be 99%.

(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.

(f) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

7.3 Fuel cask drop

(a) Noble gas gap activity from one fully loaded fuel cask (120 day cooling) shall be assumed to be released. (Gap activity shall be 1% of total activity in the pins).

ACCIDENT–8.0 Accident Initiation Events Considered in Design Basis Evaluation in the Safety Analysis Report

8.1 Loss-of-coolant accidents

Small Pipe Break (6-in. or less)

(a) Source term: the average radioactivity inventory in the primary coolant shall be assumed. (This inventory shall be based on operation with 0.5% failed fuel).
(b) Filter efficiencies shall be 95% for internal filters and 99% for external filters.
(c) 50% building mixing for boiling water reactors shall be assumed.
(d) For the effects of plateout, sprays, decontamination factor in pool, and core sprays the following reduction factors shall be assumed:

For pressurized water reactors: 0.05 with chemical additives in sprays, 0.2 for no chemical additives.

For boiling water reactors: 0.2.

(e) A realistic building leak rate as a function of time shall be assumed.
(f) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.
(g) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

Large Pipe Break

(a) Source term: The average radioactivity inventory in the primary coolant shall be assumed (This inventory shall be based on operation with 0.5% failed fuel), plus release into the coolant of:

For pressurized water reactors: 2% of the core inventory of halogens and noble gases.

For boiling water reactors: 0.2% of the core inventory of halogens and noble gases.

(b) Filter efficiencies shall be 95% for internal filters and 99% for external filters.
(c) 50% building mixing for boiling water reactors shall be assumed.
(d) For the effects of plateout, containment sprays, core sprays (values based on 0.5% of halogens in organic form) the following reduction factors shall be assumed:

For pressurized water reactors: 0.05 with chemical additives in sprays, 0.2 for no chemical additives.

For boiling water reactors: 0.2.

(e) A realistic building leak rate as a function of time and including design leakage of steamline valves in BWRs shall be assumed.
(f) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3 or 4.
(g) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

8.1(a) Break in instrument line from primary system that penetrates the containment (Lines not provided with isolation capability inside containment).
(a) The primary coolant inventory of noble gases and halogens shall be based on operation with 0.5% failed fuel.
(b) Release rate through failed line shall be assumed constant for the four hour duration of the accident.
(c) Charcoal filter efficiency shall be 99%.
(d) Reduction factor from combined plateout and building mixing shall be 0.1.
(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3.
(f) Consequences shall be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

8.2(a) Rod ejection accident (pressurized water reactor)
(a) 0.2% of the core inventory of noble gases and halogens shall be assumed to be released into the primary coolant plus the average inventory in the primary coolant based on operation with 0.5% failed fuel.
(b) Loss-of-coolant accident occurs with break size equivalent to diameter of rod housing (See assumptions for Accident 8.1).

8.2(b) Rod drop accident (boiling water reactor)

Radioactive material released

(a) 0.025% of the core inventory of noble gas and 0.025% of the core inventory of halogens shall be assumed to be released into the coolant.
(b) 1% of the halogens in the reactor coolant shall be assumed to be released into the condenser.
(c) The mechanical vacuum pump shall be assumed to be automatically isolated by high radiation signal on the streamline.
(d) Radioactivity shall be assumed to carry over to the condenser where 10% of the halogens shall be assumed to be available for leakage from the condenser to the environment at 0.5%/day for the course of the accident (24 hours).
(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 3.
(f) Consequences should be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

8.3(a) Steamline breaks (pressurized water reactors–outside containment)

Break size equal to area of safety valve throat

Small break

(a) Primary coolant activity shall be based on operation with 0.5% failed fuel. The primary system contribution during the course of the accident shall be based on a 20 gal/day tube leak.
(b) During the course of the accident a halogen reduction factor of 0.1 shall be applied to the primary coolant source when the steam generator tubes are covered; a factor of 0.5 shall be used when the tubes are uncovered.
(c) Secondary coolant system radioactivity prior to the accident shall be based on:
  (a) 20 gallons per day primary-to-secondary leak.
  (b) Blowdown of 10 gpm.
(d) Volume of one steam generator shall be released to the atmosphere with an iodine partition factor of 10.
(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 4.
(f) Consequences shall be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

Large break

(a) Primary coolant activity shall be based on operation with 0.5% failed fuel. The primary system contribution during the course of the accident shall be based on a 20 gal/day tube leak.
(b) A halogen reduction factor of 0.5 shall be applied to the primary coolant source during the course of the accident.
(c) Secondary coolant system radioactivity prior to the accident shall be based on:
  (a) 20 gallons per day primary-to-secondary leak.
  (b) Blowdown to 10 gpm.
(d) Volume of one steam generator shall be assumed to be released to the atmosphere with an iodine partition factor of 10.
(e) Meteorology assumptions: χ/Q values shall be 1/10 of those given in AEC Safety Guide No. 4.
(f) Consequences shall be calculated by weighing the effects in different directions by the frequency the wind blows in each direction.

8.3(b) Steamline breaks (boiling water reactor)

Small pipe break (of ¼ ft^2)

(a) Primary coolant activity shall be based on operation with 0.5% failed fuel.
(b) The main steamline shall be assumed to fail releasing coolant until 5 seconds after isolation signal is received.
(c) Halogens in the fluid released to the atmosphere shall be at 1/10 the primary system liquid concentration.
(d) Meteorology assumptions: χ/Q values shall be 1/10 of these in AEC Safety Guide No. 3.
(e) Consequences shall be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

Large break

(a) Primary coolant activity shall be based on operation with 0.5% failed fuel.
(b) Main steamline shall be assumed to fail

releasing that amount of coolant corresponding to a 5 second isolation time.

(c) 50% of the halogens in the fluid exiting the break shall be assumed to be released to the atmosphere.

(d) Meteorology assumptions: χ/Q values shall be 1/10 of those in AEC Safety Guide No. 3.

(e) Consequences shall be calculated by weighting the effects in different directions by the frequency the wind blows in each direction.

7.2 Transportation accidents[3]

The potential environmental effects from a transportation accident involving radioactive materials should be evaluated. Even though the probability of such an accident may be low and its consequences small, the applicant should identify the environmental effects that might result. Adequate documentation should be presented to provide assurance that all safety requirements will be met prior to transportation of radioactive materials.

7.3 Other accidents

In addition to accidents that can release radioactivity to the environs, there may be accidents that, although radioactive materials are not involved, do have consequences that affect the environment. Such accidents as chemical explosions or fires, steam boiler failures, leakage or ruptures of vessels containing toxic materials can have significant environmental impacts. These possible accidents and associated effects should be identified and evaluated.

8. ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

Social and economic effects of a nuclear power plant may be mixed. Some may be beneficial, as exemplified by increased employment opportunities and augmented commerce. Other effects may be adverse, such as the loss or displacement of local agricultural or residential property.

The applicant should assess the social, cultural and economic consequences of achieving the objectives of the facility. Any additional effects resulting from the proposed plant which are not in themselves direct objectives of the facility and its operation may also be discussed in this Section. Such effects would include attraction of industrial or other activities. The discussion of these effects should include both beneficial and adverse social and economic consequences.

The Commission recognizes that some effects cannot be monetized, particularly in the area of social impact. The applicant may, accordingly, elect to use other than monetary measures. Where monetary measures are used, dollar estimates should be discounted to their present value using a prescribed rate of 10% as suggested by OMB for Federally sponsored projects. The applicant may select a different rate; if so, the choice should be justified and well documented. In any case, documentation of the analysis should be provided in sufficient detail to permit the AEC to make an independent calculation of present value.

AEC Form provides for the summary display of benefit measures.[1]

8.1 Value of delivered products

In this Section the applicant may, in presenting the value to society of the proposed facility, provide a breakdown of the distribution of the plant products (electric energy, steam, etc.) to the various sectors of customers served. The discussion should include present and projected values of electrical energy and any by-products generated by the facility. In addition, the applicant may detail expected end uses of the products. In the case of electrical energy, it would be appropriate to quantify, where possible, such uses in terms of major consumer applications. Residential applications might include examples of ways in which electric power contributes to raising the standard of living, i.e., improved lighting and heating, frostless refrigeration and air conditioning, home entertainment, air cleaners, trash compactors. Particular attention may be given to any significant public benefit such as might be associated with security, safety, general convenience including adequate street lighting, power for hospitals, rapid transit systems and other public facilities. Conversely, the discussion may include consideration of any important regional deficiencies which would be ameliorated by operation of the proposed facility. This might include retirement of polluting industrial facilities through substitution of electric power or use of power for operating water treatment or pollution

[3] The radiological impact of transportation in the absence of accidents if to be discussed in Section 5.3.4.2.

[1] This and other forms appear after Section 13 of this Guide.

control facilities. Dis-benefits associated with the projected benefits should be identified and discussed.

8.2 Income

Expenditures for the construction and operation of a nuclear power plant represent an addition to national as well as regional income. While the total expenditure would add to national income, expenditures within a particular region would constitute a local income gain. Thus, the applicant should identify the amount of outlay for labor, materials and equipment that will be expended in the region in which the plant will be constructed and that which will be expended nationally. Successive rounds of local income, beyond the direct plant expenditure, will be generated by the construction and continued operation of the facility, so that the total addition to regional income will be much greater than the initial expenditure. The applicant may therefore estimate an income multiplier for the region.

8.3 Employment

The construction and operation of a nuclear power plant will have an impact on regional employment. It may create jobs in the national economy, as well as in local industrial and service sectors in addition to those jobs directly created by the construction and operation of the plant. As in the case of income, a local multiplier is involved and the applicant may estimate an employment multiplier for the region in which it is proposed to construct the plant in order to determine the total effect on regional employment.

Conceptually this may be regarded as a form of double-counting, because the incremental regional income is roughly proportional to the incremental regional employment. However, this approach may be useful because incremental employment may be easier to estimate.

8.4 Taxes

Local tax revenues may be significantly increased by the construction and operation of a nuclear power plant. The tax base would be increased by the addition of the plant itself, other new commercial property, and by new residential property as required. The applicant should estimate the addition to the region's tax base and revenues and provide the basis for the estimates.

8.5 Externalities

The production of more, and perhaps lower cost electricity, could induce local industry to increase the production of goods and services, thereby increasing the region's gross product and employment. This increment would be in addition to the increase resulting from the construction and operation of the proposed plant. Conversely, increased industrial activities could lead to adverse environmental effects in themselves, such as increased air pollution. The applicant should estimate both favorable and unfavorable effects.

There could be other adverse effects on a region's economy. While the proposed facility would increase a region's tax base, it would also add an additional burden to local services, such as water, sewage, education, and transportation. The applicant should therefore estimate such adverse effects as well as the benefits.

8.6 Other effects

The applicant may wish to consider other economic and social effects beneficial to the region, such as increased recreational activity, improvements in navigation in adjacent waters, and increased educational and environmental research benefits.

Recreational benefit may be projected on the basis of expected annual user-days or the present value in dollars of future use. Evaluation of benefits achieved by facilitating navigation in affected water bodies may follow the guidelines of the Army Corps of Engineers.[1] The applicant should select and justify appropriate measures for evaluating these and any other benefits described.
The applicant should summarize information from Section 2.2 concerning present and projected land and water use in the region and should supply a documented "qualified opinion" of the associated economic and social consequences.

Additional benefits may be discussed by the applicant and presented to AEC Form 1. Both quantitative measurements and qualitative assessments should be used in deriving an evaluation of the net of the benefits and adverse effects caused by the plant construction and operation.

[1] Department of the Army, Office of the Chief of Engineers, Regulation No. 1120-114, dated June 1, 1968, entitled "Survey Investigations and Reports: Water Improvement Studies–Navigation Benefits."

9. ALTERNATIVE ENERGY SOURCES AND SITES

In this Section of the Environmental Report the applicant's choice of a particular proposed nuclear facility at a particular proposed site will be supported through a comparative evaluation of available alternatives. The AEC will consider available alternatives which may reduce or avoid adverse environmental effects expected to result from construction and operation of a proposed nuclear facility. The AEC will not specify in advance which alternatives should be selected by the applicant for consideration; rather, the applicant should make this selection and also make clear the basis for the choices in regard to number, availability and suitability, as well as factors limiting the range of alternatives.

Two classes of alternatives should be considered: those which can meet the power demand without requiring the creation of new generating capacity and those which do require the creation of new generating capacity.

9.1 Alternatives not requiring the creation of new generating capacity.

Practicable means which meet the projected power demand with adequate system reliability and which do not require the creation of additional generating capacity should be identified and evaluated. Such alternatives may include purchased energy, reactivation or upgrading an older plant, and/or base load operation of an existing peaking facility. Such alternatives should be analyzed in terms of cost, environmental impact, adequacy, reliability and other pertinent factors. The applicant is advised that this analysis is of major importance because it provides the basis for justifying the creation of a new generating capability.

9.2 Alternatives requiring the creation of new generating capacity.

In this Section an alternative requiring new generating capacity is termed a "site-plant combination" in order to emphasize that the alternatives to be evaluated should include both site and energy source options. By site-plant combination is meant a combination of a specific site (which may include the proposed site) and a particular category of energy source (nuclear, fossil-fueled, hydroelectric, geothermal) together with the transmission hook-up. A given site considered in combination with two different energy sources is regarded as providing two alternatives.

9.2.1 Selection of candidate regions [1]

Meaningful evaluation of site-plant alternatives can be made only after a selection process which identifies realistic candidate choices within the larger group of technically feasible site-plant combinations. In the initial screening, the applicant should identify geographical regions (both within and outside of the applicant's franchise service area) which may contain potential site locations. It is expected that these regions will be small enough so that any site developed within a given region would have approximately the same type of environmental relationship (i.e., thermal discharge to some body of water, proximity to urban areas, etc.); however, actual sites may not be owned within these areas; detailed land availability may not be known; detailed transmission line routings will be unspecified.

In this Section the applicant should appraise the identified regions with respect to power network considerations, environmental considerations and energy type and source considerations. This appraisal will result in the elimination of certain geographical regions because of such disadvantages as poor location with respect to the applicant's power network, lack of cooling water, or obvious environmental incompatibility. The remaining regions will be those in and from which candidate site-plant alternatives will be selected. (The latter selection process is discussed in Section 9.2.2.)

As an initial step in appraising the identified regions, the applicant should prepare two sets of maps, one of which will be related to power network considerations and the other to environmental considerations. Each map should clearly show all regions considered. (The regions should be numbered and the same numbering system used on all maps in which they appear.)

Power network considerations.[2] The map or maps related to power network considerations should show the following:

a. The applicant's total service area.

[1] As used in Section 9, the term "region" is defined as several square miles (large enough to contain several sites).

[2] To avoid repetition, the applicant should refer, as appropriate, to material presented in Section 1.1.

b. Relevant service subareas.
c. Regions considered by applicant.
d. Major urban areas, water bodies, and political boundaries such as county lines where significant.
e. Primary generating plants, together with effective operating capacity in megawatts, both electrical and thermal, and indication of fuel type (all plants of same type at same location should be lumped together).
f. Transmission lines of 115 kV or higher, and termination points on the system for proposed and potential lines from the applicant's proposed facility.
g. Major interconnections with other power suppliers.

If other generating additions to the network are to be installed before the proposed facility goes on-line, these should also be shown.

Where the following considerations affect the decision process, separate tables should indicate, for each of the subareas shown under (b) above:
a. The estimated peak and average power demand;
b. The generating capacity;
c. Firm net power to be exported or imported at major interconnections (transient load swinging and through-power transfers should be eliminated).

All amounts should be estimated for load conditions during initial year of full operation of the applicant's proposed facility, using data consistent with power projections.

Environmental considerations. The map or maps related to environmental considerations should show the following:
a. The applicant's total service area,
b. Adjacent service areas,
c. Regions considered by the applicant,
d. Major areas of population density (urban, high, medium, low density or similar scale),
e. Water bodies suitable for use in cooling systems.
f. Railroads, highways, and waterways suitable for fuel and waste transportation,
g. Unsuitable topographic features (such as mountains marshes, fault lines),
h. Dedicated land-use areas (parks, historical sites, wilderness areas, testing grounds, airports, etc.),

and any other environmental factors, suitable for display, which are appropriate to the discussion under 9.2.2 below.

The number of maps to be furnished will depend on the number of geographical regions considered during the selection process.

Maps of regions outside the service area should include the likely transmission corridor to the applicant's system interconnection.

Supplementary important environmental information should be included with the environmental maps for completeness.

The supplementary information should include:
a. Prevailing meterological conditions,
b. General environmental characteristics of rivers, lakes (capacity, biota, applicable standards),
c. Local habitat (animal population, vegetation, bird migration or nesting),
d. Prevailing and projected land use.

Suitable cross-referencing may be made between the maps. For example, one or more of the environmental maps may be to the same scale as the power map; or, current generation sites and major transmission lines may be overlaid on the environmental maps, where this is appropriate to the discussion of 9.2.2.

Energy type and source considerations. The applicant should present a summary analysis of the availability of fuel or other energy source actually assumed in the planning process. It is recognized that conditions with regard to alternatives to nuclear fuel will vary greatly for different applicants. Oil and coal may be readily available in many areas, although limitations on maximum sulfur content or transportation costs may restrict or prevent their use. Natural gas may be an available alternative in some areas. The applicant should make clear at what point considerations of reliable fossil fuel supply and facilities for its transportation, as well as of hydroelectric and geothermal sources, entered the planning process. The

discussion should clearly establish the energy source alternatives.

Using the materials prepared as described above, the applicant should provide a condensed narrative description of the major issues which led to the elimination of certain regions and to the final selection of the candidate regions.

The following remarks may apply in specific instances:

a. It is anticipated that the first general geographic selection will be based on power load and transmission considerations;
b. In selecting candidate regions, the applicant may consider expansion of currently used and/or owned sites;
c. Certain promising regions may be pinpointed early in the decision process and, because of transportation or geophysical characteristics, may be suitable for only one type of fuel;
d. Other regions may be rather broadly defined at this stage of analysis (e.g., a stretch of coast line) and may admit several fuel type solutions;
e. Not all regions will receive the same detailed consideration in the selection process; for example, some regions will be eliminated early in the selection process by consideration of environmental impacts or transmission or operating costs. Other regions may be preferred in the final selection because their dominance over other possibilities is based on a mixture of environmental and engineering factors.
f. Only salient characteristics of the identified regions need be considered. Specific tracts need not be identified, unless already owned by the applicant.
g. If regions outside the service area were not considered during this phase of the decision process, the reasons for their elimination should be discussed.
h. If certain fuel types are eliminated in selecting candidate regions because of predicted nonavailability or economic factors, appropriate supporting evidence should be provided.

The applicant is reminded that the purpose of this Section is to exclude from further consideration those identified regions having less desirable characteristics which are readily recognizable without extensive analysis. This stage of the selection process can thus be regarded as a screening procedure.

9.2.2 Selection of candidate site-plant alternatives

At this point the applicant should identify, within each of the selected regions, practicable potential site(s) and the associated energy source(s) considered suitable for each site. From these identified site-plant combinations the applicant should then select those regarded as most suitable, i.e., those whose construction and operation would result in incurring minimal environmental and other costs without compromising the projected benefits.

The criteria to be used in selecting the candidate site-plant alternatives from all the identified site-plant combinations are essentially the same as the criteria already used in selecting candidate regions. The criteria, however, must now be applied in greater depth because the differences in desirability of the various site-plant combinations will be less obvious than those of the initially identified regions. Furthermore, while the unsuitability of a rejected identified region could be established by noting one major overriding disadvantage, the suitability of a given site-plant combination must be determined by balancing both favorable and unfavorable factors (benefits versus environmental and other costs).

The range of candidate site-plant alternatives selected by the applicant should include other energy source options (coal, oil, gas, hydro, geothermal) as practicable.

The applicant should discuss in detail the process of selection used and clearly identify the bases for the choice or rejection of each candidate site-plant alternative.

The applicant's discussion should include consideration of the compatibility of the proposed development of the site with sound principles of land use planning. Views of cognizant local planning groups and interested citizens should be solicited and summarized. Areas of both consistency and conflict of the proposed site use with any regional development program should be specified and discussed.

In addition to criteria already cited, the applicant should note:

a. If considerations of alternative transmission hook-ups are required by other local, State, or Federal agencies, or if the applicant has made a choice between practicable alternative hook-ups, these alternatives should be identified and described.

b. In eliminating a fuel source at a site on the grounds of cost, the applicant should make clear that the excess costs over a preferred alternative outweigh any potential advantages of the eliminated fuel with respect to environmental protection.

9.3 Comparison of practicable alternatives and the proposed facility

The purpose of this Section is to show, by direct comparison of realistic alternatives, in terms of both economic and environmental criteria, why the proposed site and nuclear fuel are preferred over any other alternatives for meeting the power demand.

In presenting the results of comparison of site-plant alternatives, the applicant should utilize, in so far as possible, a tabular format showing side-by-side comparison of alternatives with respect to relevant factors. It is recommended that comparisons first be made separately between fossil-fueled alternatives, nuclear-fueled alternatives, and other alternatives (including those discussed in Section 9.1), if any exist. The comparison should clearly indicate, in terms of economic and environmental factors, the basis for the preferred site-plant alternative in each energy source category.

A further tabular presentation should then be made, demonstrating the balanced preference of the proposed site with nuclear fuel over the best fossil fuel and best other, if any, alternatives (including those discussed in Section 9.1). Tabular presentations should be supplemented with brief resumes of the factors which ruled out alternatives other than the applicant's preferred choice.

Quantification, while desirable, is not mandatory for all factors used when it can be made clear that data are not reasonably available for comparison. Under such circumstances, qualitative and general comparative statements are permissible. The basis for such statements should be made clear by accompanying documentation. Where possible, operating experience from nearby plants may be helpful in appraising the nature of environmental impacts to be anticipated.

This guideline does not make mandatory any specific list of criteria with respect to which alternatives and the proposed facility must be compared. The factors presented should be those used by the applicant in a selection process which weighs the projected benefits against environmental and other[3] costs. While the comparative analysis should clearly set forth the general environmental and other relevant features, it is not expected that the applicant will conduct extensive field studies at each of the alternative sites. The following list of additional evaluatory considerations is offered for further guidance.

Benefits:

- Contributions to generating capacity and system reliability.
- Possibilities for the beneficial delivery of waste heat.
- Creation of additional benefits such as added park land and recreational facilities, reductions in air pollutant emissions where existing old capacity is partially or entirely replaced.

Engineering Constraints of the Site:

- Geology
- Seismology
- Hydrology
- Population density in site environs
- Access to road, rail, and water transportation
- Fuel supply and waste disposal routes
- Cooling water supply

Constraints of Transmission Hook-Up:

- Access to transmission system in place
- Problems of routing new transmission lines
- Problems of transmission reliability
- Minimization of transmission losses

Construction Constraints:

- Access for equipment and materials
- Access, housing, etc., for construction workers

[3] The applicant may use, if the necessary data are available, the method for calculating generating cost discussed in Section 10.

Land Use Constraints

Costs:

Construction costs
Costs of transmission hook-up
Operating costs

Environmental Constraints:

Sensitivity of aquatic and terrestrial habitats affected
Risks and uncertainties with regard to potential impacts
Commitment of resources
Projected recreational usage
Scenic values

Operating Constraints:

Load-following capability
Transient response.

10. PLANT DESIGN ALTERNATIVES

Most of the environmental effects of a nuclear power plant will be associated with the operation of certain identifiable systems. The applicant's proposed plant should incorporate a combination of these identifiable systems each of which has been selected, through evaluation of environmental, economic and other costs, as the optimal choice within its category. In some instances, the interaction of these systems may be such as to require their selection on the basis of an optimal combination rather than on the basis of individual optimal systems. For example, an alternative cooling system may have to be evaluated in combination with a preferred chemical effluent system that would be used with it.

The applicant should, in this Section, show how the proposed plant design was arrived at through consideration of alternative designs of identifiable systems and through their comparative assessment. The applicant's discussion should be organized on the basis of plant systems, arranged according to the following list:

1. Cooling system (exclusive of intake and discharge)
2. Intake system
3. Discharge system
4. Chemical systems
5. Biocide systems
6. Sanitary waste system
7. Liquid radwaste systems
8. Gaseous radwaste systems
9. Transmission facilities
10. Other systems

The following should be considered in preparing the discussion:

a. **Range of alternatives**—The applicant's discussion should emphasize those alternative plant systems that appear promising in terms of environmental protection. Different designs for systems that are essentially identical with respect to environmental effects should be considered only if their costs are appreciably different. The applicant should include alternatives which provide levels of environmental protection above those of the proposed facility when, although not necessarily economically attractive, they are practicable on technological grounds.

b. **Normalization of cost comparison**—Alternatives should be compared on the basis of assuming a fixed amount of energy generated for distribution outside the plant. (Thus, any effect of an alternative on plant power consumption should be discussed.)

c. **Effect of capacity factor**—Where the cost of operation affects the plant capacity factor, the effect of alternatives on the plant capacity factor should be documented.

d. **Monetized costs**—The acquisition and operating costs of individual systems and their alternatives (as well as costs of the total plant and transmission facility and alternatives) are to be expressed as power generating costs. The latter will be derived from cost elements compounded or discounted (as appropriate) to their present values as of the date of initial commercial operation and will be converted to their annualized values. The method of computation is shown in Table 1 and the individual cost items in this table are to be used as applicable. The total cost will be the sum of:

Capital to be expended between the date of submission of the Environmental Report and the scheduled date of operation.

Interest to the date of operation on all expenditures prior to that date.

Expenditures subsequent to the scheduled date of operation discounted to that date. In calculations, the applicant should assume a 30-year plant life.[1]

[1] Use 30-year life for steam-electric generating plants. For other types of electric generating plants, use generally accepted values.

In computing the annualized present value of plant systems and their alternatives, the following cost elements are suggested as allowable:

Engineering design and planning costs.

Construction costs.

Interest on capital expended prior to operation.

Operating, maintenance and fuel (if applicable) costs over the 30-year life of the plant.

Cost of modification or alteration of any other plant system if required for accommodation of alternatives.

Maintenance costs for the transmission facility (if applicable).

Cost of supplying make-up power during a delay resulting from an alternative design choice which will not meet the power requirement by the scheduled in-service date.

e. **Environmental costs.** Environmental effects of alternatives should be fully documented. To the extent practicable, the magnitude of each effect should be quantified. Where quantification is not possible, qualitative evaluations should be expressed in terms of comparison to the effects of the subsystem chosen for the proposed design. In either case, the derivation of the evaluations should be completely documented.

Both short-term and long-term environmental effects should be reported by the applicant. Table 2 provides three key elements of environmental cost evaluation:

(1) A description of each effect to be measured (column 3).
(2) Suggested units to be used for measurement (column 4). The AEC recognizes the difficulty, if not the impossibility, of using the assigned units for every item in Table 2 in each case, given the current state-of-the-art. The applicant may elect to use other units, provided they are meaningful to the informed public and adequately reflect the impact of the listed environmental effects.
(3) A suggested methodology of computation (column 5). Computation of effects in response to each block in Table 2, e.g., 1.1, 1.2 etc., should be given without adjustment for effects computed in other blocks for the same population or resource affected. However, provision is made in Table 2 (i.e., 1.9 and 4.9) to account for combined effects that may be either less than or greater than the sum of individual effects.

In discussing environmental effects, the applicant should specify not only the magnitude of the effect (e.g., pounds of fish killed, acres of a particular habitat destroyed) but also the relative effect, that is the fraction of the population or resource that is affected. See discussion in Section 5.8.

In some specific cases, accurate estimation of an effect which the applicant believes to be very small may require a data collection effort that would not be commensurate with the value of the infomation to be obtained. In such cases, the applicant may substitute a preferred measure which conservatively estimates environmental costs for the effect in question, provided the substituted measure is clearly documented and realistically evaluates the potentially detrimental (i.e., worst case) aspects of the effect, and provided the measure is applied consistently to all alternatives.

In the following subsections, the applicant is to discuss design alternatives for each of the relevant plant systems (i.e., cooling system, intake system, etc.). The discussion should describe each alternative and should present estimates of the difference between its environmental impact and that of the proposed system. The assumptions and calculations on which the estimates are based should be presented, and the results should be entered in the appropriate forms. In the columns headed "Page," the applicant should cite the appropriate references to the text of his Report. Note that, in the forms, the categorization and numerical identification of each environmental effect corresponds to that of Table 2. In each of the forms used in the subsections 10.1 to 10.9 the applicant must include, in the first "A" column, data on the system selected in the applicant's proposed design.

Each supplemental form provides space for the display of data regarding four alternatives; however, the applicant is neither obligated to consider, nor limited to, any precise number. The applicant should limit the discussion to those alternatives which the current state-of-the-art indicates are technically practicable.

The monetized costs of the proposed systems and alternatives to be entered in the supplemental forms are to be presented on an incremental basis. This means that the costs of the proposed systems would

appear as zeroes in the "A" columns of the forms and that the costs of the other alternative systems (B, C, D, etc.) should appear as cost differences, i.e., B–A, C–A, etc., with the appropriate sign. The environmental costs are not incremental and the supplemental forms should therefore show these as the total costs, whether monetized or not. (If an environmental effect is considered beneficial, the entry should be preceded by a negative sign.)

In addition to the information displayed on forms, the applicant should provide a verbal description of the process by which the trade-offs were weighed and balanced in arriving at the proposed design. This discussion may include any factors not provided for on the forms supplied.

10.1 Cooling system (exclusive of intake and discharge)

The applicant should identify and describe cooling system alternatives to the proposed design. Estimates of environmental effects should be prepared and presented on AEC Form

10.2 Intake system

The applicant should identify and describe intake system alternatives to the proposed design. Estimates of environmental effects should be prepared and presented on AEC Form

10.3 Discharge system

The applicant should identify and describe discharge system alternatives to the proposed design. Estimates of environmental effects should be prepared and presented on AEC Form

10.4 Chemical systems

Alternative chemical systems that have the potential for reduced adverse environmental effects should be described and the environmental impacts of effluents should be fully identified. Corrosion products as well as corrosion inhibitors should be considered.

The description should include specification of both maximum and average concentrations and dilution sources. (Where a discharge is not continuous, the discharge schedule should be specified.) Any toxicity and lethality to affected biota should be documented for all potential points of exposure. Specifically, information should be sufficient to define the impacts to entrained organisms at their points of exposure as well as the impacts beyond the point of discharge. Estimates of environmental effects should be prepared and presented on AEC Form

10.5 Biocide systems

The applicant should describe alternative systems for control of fouling organisms, including both mechanical and chemical methods where such alternative systems may be expected to have less severe environmental effects than the proposed system. The treatment of chemical biocides should be similar to that specified above for chemical effluent treatment. Estimates of environmental effects should be prepared and presented on AEC Form

10.6 Sanitary waste system

Alternative sanitary waste systems should be identified and discussed with regard to the environmental implications of both waste products and chemical additives for waste treatment. Estimates of environmental effects should be prepared and presented on AEC Form

10.7 Liquid radwaste systems

For proposed light-water cooled reactor installations in which the quantities of radioactive material in effluents will be limited to levels that are within the numerical guides for design objectives and limiting conditions of operation set forth in the Commission's proposed amendments (dated June 9, 1971) to 10 CFR Part 50 and embodied in a new Appendix I (reproduced in Appendix 4 of this Guide), no further consideration need be given to the reduction of radiological impacts in formulating alternative plant designs. If the reactor is not a light-water cooled reactor, the possibility must be explored of an alternative radwaste system which reduces the level of radioactivity in the effluents and direct radiation to the levels proposed in Appendix I. In any case, for reactors to which the proposed Appendix I does not apply, the applicant should demonstrate sufficient consideration of alternative radwaste systems and of their radiological output to assure that releases from the proposed facility will be as low as practicable.

10.8 Gaseous radwaste systems

Consideration of systems for the disposal of gaseous radwaste is subject to the qualifying condition noted under 10.7 above.

10.9 Transmission facilities

The applicant will discuss the cost and environmental effects of alternative routes for new transmission facilities required for tie-in of the proposed facility to the applicant's system. The documentation should include maps of the alternative routes. These maps should clearly indicate topographic features important to evaluation of the routes and boundaries of visually sensitive areas. The applicant may find the documents cited in Section 3.9 helpful in this analysis. Estimates of environmental effects should be prepared and presented on AEC Form

10.10 Other systems

Any plant system, other than those specified above, which is associated with an adverse environmental effect, should be discussed in terms of practicable and feasible alternatives that may reduce or eliminate this environmental effect.

10.11 The proposed plant

Having identified the preferred alternative system, the applicant should now provide the cost description of the proposed facility and transmission hook-up. AEC Form is provided for this purpose. In addition to those elements previously suggested as allowable in computing plant system costs, the applicant may include the cost of site and right-of-way acquisition and preparation.

Note that the generating and transmission cost entries on AEC Form are not to be incremental and, hence, should appear as total values.

11. SUMMARY BENEFIT-COST ANALYSIS

In this Section the applicant's summary benefit-cost statement will be presented. The presentation should be made in the form of a narrative with accompanying tables and charts. The presentation should make clear what the applicant considers to be the important benefits and costs of the proposed facility and why in the judgment of the applicant, the former outweigh the latter.

The applicant will have to develop criteria for assessing and comparing benefits and costs where these are expressed in nonmonetary or qualitative terms. The rationale for the selection among site-plant alternatives, as well as among subsystem alternatives, should be presented. In any case, the applicant should carefully describe any aggregation of effects and discuss in detail the trade-offs that were made in order to justify the proposed plant. If any of the benefits or costs are deleted from the applicant's analysis, the rationale for doing so should be explained. The applicant should key all the terms used in the summary benefit-cost analysis to the relevant Sections of the Environmental Report.

12. ENVIRONMENTAL APPROVALS AND CONSULTATION

List all licenses, permits and other approvals of plant construction and operations required by Federal, State, local and regional authorities for the protection of the environment. List those Federal and State approvals which have already been received, and indicate the status of matters regarding approvals yet to be obtained.[1] For general background, submit similar information regarding approvals, licenses and contacts with local authorities.

List all licenses, permits and other approvals and cite laws and regulations applicable to the transportation of fresh fuel, irradiated fuel, and radioactive wastes. Include restrictions on routes or specification of routes imposed by cognizant local, State or other authorities.

List all laws or ordinances applicable to the proposed transmission system and the status of approvals that must be obtained. Indicate any public hearings held or to be held with respect to the proposed transmission system.

The listing should cite the relevant statutory or other authority requiring approvals with respect to the construction and/or operation of the plant and should be categorized by the environmental impact to which the approval is addressed. These categories could include, for example, air, land and water use and planning, fish diversion, and construction effects.

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[1] Includes, for example, the status of applications to the U.S. Army Corps of Engineers for permits to dredge, to discharge or deposit materials into navigable waters or their tributaries as required by Sec. 10 (33 U.S.C. 403) and Sec. 13 (33 U.S.C. 407, "The Refuse Act") of the Rivers & Harbors Act of 1899.

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Consideration of systems for the disposal of gaseous radwaste is subject to the qualifying condition noted under 10.7 above.

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Any plant system, other than those specified above, which is associated with an adverse environmental effect, should be discussed in terms of practicable and feasible alternatives that may reduce or eliminate this environmental effect.

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The listing should cite the relevant statutory or other authority requiring approvals with respect to the construction and/or operation of the plant and should be categorized by the environmental impact to which the approval is addressed. These categories could include, for example, air, land and water use and planning, fish diversion, and construction effects.

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[1] Includes, for example, the status of applications to the U.S. Army Corps of Engineers for permits to dredge, to discharge or deposit materials into navigable waters or their tributaries as required by Sec. 10 (33 U.S.C. 403) and Sec. 13 (33 U.S.C. 407, "The Refuse Act") of the Rivers & Harbors Act of 1899.

Discuss the status of efforts to obtain a water quality certification under Section 21(b) of the Federal Water Pollution Control Act, as amended. If not already obtained, indicate when certification is expected. If certification is not required, explain.

If the discharge could alter the quality of the water of another State, indicate the State or States that may be affected and their applicable water quality standards.

In view of the effects of the plant on the economic development of the region in which it is located, the applicant should also note the State, local, and regional planning authorities contacted or consulted. The OMB Circular A-95 identifies the State, metropolitan, and regional clearinghouses that should be contacted as appropriate. (A listing of applicable clearinghouses may be obtained from the AEC.)

Cite meetings held with environmental and other citizen groups with reference given to specific instances of the applicant's compliance with citizen group recommendations.

13. REFERENCES

The applicant should provide a bibliography of sources used in preparation of the Environmental Report. References cited should be keyed to the specific sections to which they apply.

Table I—MONETIZED BASES FOR GENERATING COSTS*

ITEM	SYMBOL	UNITS	ITEM DESCRIPTION
Total Outlay Required to Bring Facility to Operation	C_I	$	All capital outlays including interest expense to be invested in completion of the facility compounded to present value as of the scheduled in-service date of operation.
Annual Operating Cost	O_t	$	This is the total operating and maintenance cost of plant operation in year t.
Annual Fuel Cost	F_t	$	This is the total fuel cost in year t.
Cost of Make-up Power Purchased or Supplied in Year t	P_t	$	Cost of power purchased or supplied internally in year t to make up deficiency of power associated with any alternative which introduces delay.
Discount Factor	ν		$\nu = (1 + i)^{-1}$ where i is the applicant's estimated average cost of capital over the life of this plant.
Total Generating Cost—Present Value	GC_p	$	$GC_p = C_I + \sum_{t=1}^{30} \nu^t (O_t + F_t) + \sum_{t=1}^{30} \nu^t P_t$
Total Generating Cost—Present Value Annualized	GC_a	$	$GC_a = GC_p \times \frac{i(1+i)^{30}}{(1+i)^{30}-1}$

* For conventional (nuclear or fossil fuel) steam-electric plants.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
1. Natural surface water body	(Specify natural water body affected)			
1.1 Impingement or entrapment by cooling water intake structure	1.1.1 Fish[2]	Juveniles and adults are subject to attrition.	Pounds per year (as adults by species of interest).	Identify all important species. Estimate the annual weight of each species that will be destroyed. For young-of-the-year destroyed, only the expected population that would have survived naturally need be considered.
1.2 Passage through or retention in cooling systems	1.2.1 Phytoplankton and zooplankton	Plankton population may be reduced due to mechnical, thermal and chemical effects.	Net effect in pounds per year (as adult fish by species of interest).	Field measurements are required to establish the average weight of organisms per unit volume by group (e.g., diatoms, green algae, zooplankton, etc.).
				Determine the mortality of organisms passing through the condenser and pumps. Include indirect[3] effects which affect mortality. Translate loss to pounds of fish.
	1.2.2 Fish	All life stages (eggs, larvae, etc.) which reach the condenser are subject to attrition.	Net effect in pounds per year (as adult fish by species of interest).	Identify all important species. Estimate the annual weight of each species that will be destroyed. For larvae, eggs, and young-of-the-year destroyed, only the expected population that would have survived naturally need be considered.
1.3 Discharge area and thermal plume	1.3.1 Water quality, excess heat	The rate of dissipation of the excess heat, primarily to the atmosphere, will depend on both the method of discharge and the state of the receiving water, in respect to ambient temperature and water currents.	Acres and acre-feet.	Estimate the average Btu's per hour dissipated to the receiving water at full power. Estimate the water volume and surface areas within differential temperature isotherms of 2°, 3°, and 5°F under conditions that would tend, with respect to annual variations, to maximize the extent of the areas and volumes.
	1.3.2 Water quality, oxygen availability	Dissolved oxygen concentration of receiving waters may be modified as a consequence of changes in the water temperature, the translocation of water of different quality, and aeration.	Acre-feet.	Estimate volumes of affected waters with concentrations below 5, 3, and 1 ppm under conditions that would tend to maximize the impact.
	1.3.3 Aquatic organisms	Primary producers and consumers (including fish) may be affected directly or indirectly due to adverse conditions in the plume.	Net effect in pounds per year (as adult fish by species of interest).	Field measurements are required to establish the average weight of organisms per unit volume by group. Estimate the mortality of organisms in the receiving water from direct and indirect effects. Translate loss to pounds of fish.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.
[2] "Fish" as used in this table includes shellfish and other aquatic invertebrates harvested by man.
[3] Indirect effects could include increased disease incidence, increased predation, interference with spawning, reduced metabolic rates, hatching of fish out of phase with food organisms.

Table 2—GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS—Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals and reptiles).	Suitable habitats for wildlife may be affected.	Acres.	Determine the area of wet land or water surface impaired as a wildlife habitat because of thermal discharges, including effects on food resources. Document estimates of affected population by species.
	1.3.5 Fish, migratory	A thermal barrier may inhibit migration, both hampering spawning and diminishing the survival of returning immature fish.	Pounds per year (as adult fish by species of interest).	Estimate the fraction of the stock that is prevented from reaching spawning grounds because of plant operation. Prorate this directly to a reduction in current and long-term fishing effort supported by that stock. Justify estimate on basis of local migration patterns, experience at other sites, and applicable State standards.
1.4 Chemical effluents	1.4.1 Water quality, chemical	Water quality may be impaired.	Acre-feet, %.	The volume of water required to dilute the average daily discharge of each chemical to meet applicable water quality standards should be calculated. Where suitable standards do not exist, use the volume required to dilute each chemical to a concentration equivalent to a selected lethal concentration (e.g., LD_{10}) for the most sensitive organism of commercial or ecological significance in the receiving waters. The ratio of this volume to the annual minimum value of the daily net flow, where applicable, of the receiving waters should be expressed as a percentage, and the largest such percentage reported. Include the total solids if this is a limiting factor. Include in this calculation the blowdown from cooling towers.
	1.4.2 Aquatic organisms	Aquatic populations may be affected by toxic levels of discharge chemicals or by reduced dissolved oxygen concentrations.	Pounds per year (by species as fish).	Total chemical effect on aquatic biota should be estimated. Biota exposed within the facility should be considered as well as biota in receiving waters. Supporting documentation should include reference to applicable standards, chemicals discharged and their toxicity to the aquatic populations affected.
	1.4.3 Wildlife (Including birds, aquatic and amphibious mammals, and reptiles).	Suitable habitats for wildlife may be affected.	Acres.	Estimate the area of wet land or water surface impaired as a wildlife habitat because of chemical contamination including effects on food resources. Document estimates of affected population by species.
	1.4.4 People	Recreational water uses may be inhibited.	Lost annual user days and area for dilution.	Volume of the net flow to the receiving waters required for dilution to reach established water quality standards must be determined on the basis of daily discharge and converted to either surface area or miles of shore. Cross section and annual minimum flow characteristics should be incorporated where applicable. User density for the locality must be obtained.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
				This permits estimation of lost user-days on an annual basis. Indirect recreation losses due to eutrophication and decreased fishing shall be included.
1.5 Radionuclides discharged to water body	1.5.1 Aquatic organisms	Radionuclide discharge may introduce a radiation level which adds to natural background radiation.	Rad per year.	Sum dose contributions from radionuclides expected to be released.
	1.5.2 People, external	Radionuclide discharge may introduce a radiation level which adds to natural background radiation for water users.	Rem per year for individual; man-rem per year for estimated population as of the first scheduled year of plant operation.	Sum annual dose contributions from nuclides expected to be released. Calculate for above-water activities (skiing, fishing, boating), in-water activities (swimming), and shoreline activities.
	1.5.3 People, ingestion	Radionuclide discharge may introduce a radiation level which adds to natural background radiation for ingested food and water.	Rem per year for individuals (whole body and organ); man-rem per year for population as of first scheduled year of plant operation.	Estimate biological accumulation in foods, and intake by individuals and population. Calculate doses by summing results for expected radionuclides.
1.6 Consumptive use (evaporative losses)	1.6.1 People	Drinking water supplies drawn from the water body may be diminished.	Gallons per year.	Where users withdraw drinking water supplies from the affected water body, lost water to users should be estimated.
	1.6.2 Property	Water may be withdrawn from agricultural usage and use of remaining water may be degraded.	Acre-feet per year.	Where users withdrawing irrigation water are affected, the loss should be evaluated as the sum of two volumes: the volume of the water lost to agricultural users and the volume of dilution water required to reduce concentrations of dissolved solids in remaining water to an agriculturally acceptable level.
1.7 Plant construction (including site preparation)	1.7.1 Water quality, physical	Turbidity, color or temperature of natural water body may be altered.	Acre-feet and acres.	The volume of dilution water required to meet applicable water quality standards should be calculated. The real extent of the effect should be estimated.
	1.7.2 Water quality, chemical	Water quality may be impaired.	Acre-feet, %.	To the extent possible, the applicant should treat problems of spills and drainage during construction in the same manner as 1.4.1.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
1.8 Other impacts				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.
1.9 Combined or interactive effects				Where evidence indicates that the combined effects of a number of impacts on a particular population or resource is not adequately indicated by measures of the separate impacts, the total, combined effect should be described.
1.10 Net effects				See discussion in Section 5.8.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	*Population or* Resources Affected	Description	Unit of Measure[1]	Method of Computation
2. Ground Water				
2.1 Raising/lowering of ground water levels	2.1.1 People	Availability or quality of drinking water may be decreased and the functioning of existing wells may be impaired.	Gallons per year.	Volume of replacement water for local wells actually affected must be estimated.
	2.1.2 Plants	Trees and other deep-rooted vegetation may be affected.	Acres.	Estimate the area in which ground water level change may have an adverse effect on local vegetation. Report this acreage on a separate schedule by land use. Specify such uses as recreational, agricultural and residential.
2.2 Chemical contamination of ground water (excluding salt)	2.2.1 People	Drinking water of nearby communities.	Gallons per year.	Compute annual loss of potable water.
	2.2.2 Plants	Trees and other deep-rooted vegetation may experience toxic effects.	Acres.	Estimate area affected and report separately by land use. Specify such uses as recreational, agricultural and residential.
2.3 Radionuclide contamination of ground water	2.3.1 People	Radionuclides which enter ground water may add to natural background radiation level for water and food supplies.	Rem per year for individuals (whole body and organ); man-rem per year for population as of year of first scheduled year of plant operation.	Estimate intakes by individuals and populations. Sum dose contributions for nuclides expected to be released.
	2.3.2 Plants and animals	Radionuclides which enter ground water may add to natural background radiation level for local plant forms and animal population.	Rad per year.	Estimate uptake in plants and transfer to animals. Sum dose contributions for nuclides expected to be released.
2.4 Other impacts on ground water				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
3. Air				
3.1 Fogging and icing (caused by evaporation and drift)	3.1.1 Ground transportation	Safety hazards may be created in the nearby regions in all seasons.	Hours per year.	Compute the number of hours per year that driving hazards will be increased on paved highways by fog and ice from cooling towers and ponds. Documentation should include the visibility criteria used for defining hazardous conditions on the highways actually affected.
	3.1.2 Air transportation	Safety hazards may be created in the nearby regions in all seasons.	Hours per year.	Compute the number of hours per year that commercial airports will be closed because of fog from cooling towers.
	3.1.3 Water transportation	Safety hazards may be created in the nearby regions in all seasons.	Hours per year.	Compute the number of hours per year ships will need to reduce speed because of fog from cooling towers or ponds or warm water added to the surface of the river, lake or sea.
	3.1.4 Plants	Damage to timber and crops may occur through introduction of adverse conditions.	Acres by crop.	Estimate the acreage of potential plant damage by crop.
3.2 Chemical discharge to ambient air	3.2.1 Air quality, chemical	Pollutant emissions may diminish the quality of the local ambient air.	% and pounds or tons.	The actual concentration of each pollutant in ppm for maximum daily emission rate should be expressed as a percentage of the applicable emission standard. Report weight for expected annual emissions.
	3.2.2 Air quality, odor	Odor in gaseous discharge or from effects on water body may be objectionable.	Statement.	A statement must be made as to whether odor originating in plant is perceptible at any point off-site.
3.3 Radionuclides discharged to ambient air and direct radiation from radioactive materials (in-plant or being transported).	3.3.1 People, external	Radionuclide discharge or direct radiation may add to natural background radiation level.	Rem per year for individuals (whole body and organ); man-rem per year for population as of year of first scheduled operation.	Sum dose contributions from nuclides expected to be released.
	3.3.2 People, ingestion	Radionuclide discharge may add to the natural radioactivity in vegetation and in soil.	Rem per year for individuals (whole body and organ); man-rem per year for	For radionuclides expected to be released estimate deposit and accumulation in foods. Estimate intakes by individuals and populations and sum results for all expected radionuclides.

[1] *Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.*

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
			population as of year of first scheduled operation.	
	3.3.3 Plants and animals	Radionuclide discharge may add to natural background radioactivity of local plant and animal life.	Rad per year.	Estimate deposit of radionuclides on, and uptake in plants and animals. Sum dose contributions for radionuclides expected to be released.
3.4 Other impacts on air				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
4. Land				
4.1 Site selection	4.1.1 Land, amount	Land will be preempted for construction of nuclear power plant, plant facilities, and exclusion zone.	Acres.	State number of acres preempted for plant, exclusion zone, and accessory facilities such as cooling towers and ponds. By separate schedule state the type and class of land preempted (e.g., scenic shoreline, wet land, forest land, etc.).
4.2 Construction activities (including site preparation)	4.2.1 People (amenities)	There will be a loss of desirable qualities in the environment due to the noise and movement of men, material and machines.	Number by category, years.	The disruption of community life (or alternatively the degree of community isolation from such irritations, should be estimated. Estimate the number of residences, schools, hospitals, etc., within area of visual and audio impacts. Estimate the duration of impacts.
	4.2.2 People (accessibility of historical sites)	Historical sites may be affected by construction	Visitors per year.	Determine historical sites that might be displaced by generation facilities. Estimate effect on any other sites in plant environs. Express net impact in terms of annual number of visitors.
	4.2.3 People (accessibility of archeological sites)	Construction activity may impinge upon sites of archaeological value.	Qualified opinion.	Summarize evaluation of impact on archeological resources in terms of remaining potential value of the site. Referenced documentation should include statements from responsible county, State or Federal agencies, if available.
	4.2.4 Wildlife	Wildlife may be affected.	Qualified opinion.	Summarize qualified opinion including views of cognizant local and State wildlife agencies when available, taking into account both beneficial and adverse affects.
	4.2.5 Land (erosion)	Site preparation and plant construction will involve cut and fill operations with accompanying erosion potential.	Cubic yards and acres.	Estimate soil displaced by construction activity and erosion. Beneficial and detrimental effects should be reported separately.
4.3 Plant operation	4.3.1 People (amenities)	Noise may induce stress.	Number of residents, school populations, hospital beds.	Use the Proposed HUD Criterion Guideline for Non-Aircraft Noise to establish areas receiving noise in the categories of "Clearly Unacceptable," "Normally Unacceptable" and "Normally Acceptable." For each area report separately the number of residences, the total school population, and the total number of hospital beds.
	4.3.2 People (aesthetics)	The local landscape as viewed from adjacent residential areas and neighboring historical, scenic, and recreational sites may be rendered	Qualified opinion.	Summarize qualified opinion including views of cognizant local and regional authorities when available.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2--GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS--Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
		aesthetically objectionable by the plant facility.		
	4.3.3 Wildlife	Wildlife may be affected.	Qualified opinion.	Summarize qualified opinion including views of cognizant local and State wildlife agencies when available, taking into account both beneficial and adverse effects.
	4.3.4 Land, flood control	Health and safety near the water body may be affected by flood control.	Reference to Flood Control District approval.	Reference must be made to regulations of cognizant Flood Control Agency by use of one of the following terms: Has NO IMPLICATIONS for flood control, COMPLIES with flood control regulation.
4.4 Salts discharged from cooling towers	4.4.1 People	Intrusion of salts into groundwater may affect water supply.	Pounds per square foot per year.	Estimate the amount of salts discharged as drift and particulates. Report maximum deposition. Supporting documentation should include patterns of deposition and projection of possible effect on water supplies.
	4.4.2 Plants and animals	Deposition of entrained salts may be detrimental in some nearby regions.	Acres.	Salt tolerance of local affected area vegetation must be determined. That area, if any, receiving salt deposition in excess of tolerance (after allowance for dilution) must be estimated. Report separately an appropriate tabulation of acreage by land use. Specify such uses as recreational, agricultural and residential. Where wildlife habitat is affected identify populations.
	4.4.3 Property resources	Structures and movable property may suffer degradation from corrosive effects.	Dollars per year.	If salt spray impinges upon a local community, then property damage may be estimated by applying to the local value of buildings, machinery, and vehicles a differential in average depreciation rates between this and a comparable sea-coast community.
4.5 Transmission route selection	4.5.1 Land, amount	Land will be preempted for construction of transmission line systems.	Miles, acres.	State total length and area of new rights-of-way.
	4.5.2 Land use and land value	Lines may pass through visually sensitive (that is sensitive to presence of transmission lines and towers) areas, thus impinging on their present and potential use and value.	Miles, acres.	Total length of new transmission lines and area of right-of-way through various categories of visually sensitive land.
	4.5.3 People (aesthetics)	Lines may present visually undersirable features.	Number of such features.	Estimate total number of visually undesirable features, such as: Number of major road crossings in vicinity of intersection or interchanges. Number of major waterway crossings. Number of crest, ridge, or other high point crossings. Number of "long views" of transmission lines perpendicular to highways and waterways.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2–GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS–Continued

Primary Impact	Population or Resources Affected	Description	Unit of Measure[1]	Method of Computation
4.6 Transmission facilities construction	4.6.1 Land adjacent to right-of-way	Constructing new roads for access to right-of-way may have environmental impact.	Miles.	Estimate length of new access and service roads required for alternative routes.
	4.6.2 Land, erosion	Soil erosion may result from construction activities.	Tons per year.	Estimate area with increased erosion potential traceable to construction activities.
	4.6.3 Wildlife	Wildlife may be affected.	Qualified opinion.	
4.7 Transmission line operation	4.7.1 Land Use	Land preempted by right-of-way may be used for additional beneficial purposes such as orchards, picnic areas, nurseries, hiking and riding trails.	%	Estimate percent of right-of-way for which no multiple use activities are planned.
	4.7.2 Wildlife	Modified wildlife habitat may result in changes.	Qualified opinion.	Summarize qualified opinion including views of cognizant local and State wildlife agencies when available.
4.8 Other land impacts				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.
4.9 Combined or interactive effects				Where evidence indicates that the combined effects of a number of impacts on a particular population or resource are not adequately indicated by measures of the separate impacts, the total combined effect should be described.
4.10 Net effects				See discussion in Section 5.8.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

AEC FORM _

BENEFITS FROM THE PROPOSED FACILITY

Direct Benefits

Expected Average Annual Generation in Kilowatt-Hours ..... _____
Capacity in Kilowatts ..... _____
Proportional Distribution of Electrical Energy Expected
Annual Delivery in Kilowatt-Hours:
Industrial ..... _____
Commercial ..... _____
Residential ..... _____
Other ..... _____

Expected Average Annual Btu (in millions) of Steam Sold from the Facility ..... _____
Expected Average Annual Delivery of Other Beneficial Products (appropriate physical units) ..... _____
Revenues from Delivered Benefits:
Electrical Energy Generated ..... _____
Steam Sold ..... _____
Other Products ..... _____

Indirect Benefits (as appropriate)

Taxes (Local, State, Federal) ..... _____
Research ..... _____
Regional Product ..... _____
Environmental Enhancement:
Recreation ..... _____
Navigation ..... _____
Air Quality:
SO_2 ..... _____
NO_X ..... _____
Particulates ..... _____
Others ..... _____

Employment ..... _____
Education ..... _____
Others ..... _____

COST DESCRIPTION OF PROPOSED FACILITY AND TRANSMISSION HOOK-UP

(All monetized costs expressed in terms of their present and annualized values)

Generating Cost	Present Worth Annualized		
Transmission and Hook-up Cost	Present Worth Annualized		
Environmental Costs	UNITS	MAGNITUDE	PAGE
1. Natural surface water body			
1.1 Impingement or entrapment by cooling water intake structure			
1.1.1 Fish			
1.2 Passage through or retention in cooling systems			
1.2.1 Phytoplankton and zooplankton			
1.2.2 Fish			
1.3 Discharge area and thermal plume			
1.3.1 Water quality, excess heat			
1.3.2 Water quality, oxygen availability			
1.3.3 Aquatic biota			
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)			
1.3.5 Fish, migration			
1.4 Chemical effluents			
1.4.1 Water quality, chemical			
1.4.2 Aquatic organisms			
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)			
1.4.4 People			
1.5 Radionuclides discharged to water body			
1.5.1 Aquatic organisms			
1.5.2 People, external			
1.5.3 People, ingestion			
1.6 Consumptive use (evaporative losses)			
1.6.1 People			
1.6.2 Property			
1.7 Plant construction (including site preparation)			
1.7.1 Water quality, physical			
1.7.2 Water quality, chemical			
1.8 Other impacts			
1.9 Combined or intractive effects			
1.10 Net effect			

COST DESCRIPTION OF PROPOSED FACILITY AND TRANSMISSION HOOK-UP
(Continued)

Environmental Costs	UNITS	MAGNITUDE	PAGE
2. Ground water			
2.1 Raising/lowering of ground water levels			
2.1.1 People			
2.1.2 Plants			
2.2 Chemical contamination of ground water (excluding salt)			
2.2.1 People			
2.2.2 Plants			
2.3 Radionuclide contamination of ground water			
2.3.1 People			
2.3.2 Plants and animals			
2.4 Other impacts on ground water			
3. Air			
3.1 Fogging and icing (caused by evaporation and drift			
3.1.1 Ground transportation			
3.1.2 Air transportation			
3.1.3 Water transportation			
3.1.4 Plants			
3.2 Chemical discharge to ambient air			
3.2.1 Air quality, chemical			
3.2.2 Air quality, odor			
3.3 Radionuclides discharged to ambient air and direct radiation from radioactive materials			
3.3.1 People, external			
3.3.2 People, ingestion			
3.3.3 Plants and animals			
4. Land			
4.1 Site selection			
4.1.1 Land, amount			
4.2 Construction activities (including site preparation)			
4.2.1 People (amenities)			
4.2.2 People (accessibility of historical sites)			
4.2.3 People (accessibility of archeological sites)			
4.2.4 Wildlife			
4.2.5 Land			

COST DESCRIPTION OF PROPOSED FACILITY AND TRANSMISSION HOOK-UP
(Continued)

Environmental Costs	UNITS	MAGNITUDE	PAGE
4.3 Plant operation			
4.3.1 People (amenities)			
4.3.2 People (aesthetics)			
4.3.3 Wildlife			
4.3.4 Land, flood control			
4.4 Salts discharged from cooling towers			
4.4.1 People			
4.4.2 Plants and animals			
4.4.3 Property resources			
4.5 Transmission route selection			
4.5.1 Land, amount			
4.5.2 land use and land value			
4.5.3 People (aesthetics)			
4.6 Transmission facilities construction			
4.6.1 Land adjacent to right-of-way			
4.6.2 Land, erosion			
4.6.3 Wildlife			
4.7 Transmission line operation			
4.7.1 Land use			
4.7.2 Wildlife			
4.8 Other land impacts			
4.9 Combined or interactive effects			
4.10 Net effects			

COST DESCRIPTION—ALTERNATIVE COOLING SYSTEMS

(exclusive of intake and discharge)

	ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST	Present Worth								
	Annualized								
CAPACITY FACTOR									
ENVIRONMENTAL COSTS	UNITS	Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
1. Natural Surface Water Body									
1.1 Impingement or entrapment by cooling water intake structure									
1.1.1 Fish									
1.2 Passage through or retention in cooling systems									
1.2.1 Phytoplankton and zooplankton									
1.2.2 Fish									
1.3 Discharge area and thermal plume									
1.3.1 Water quality, excess heat									
1.3.2 Water quality, oxygen availability									
1.3.3 Aquatic organisms									
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.3.5 Fish, migratory									
1.4 Chemical effluents									
1.4.1 Water quality, chemical									
1.4.2 Aquatic organisms									
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.4.4 People									
1.5 Radionuclides discharged to water body									
1.5.1 Aquatic organisms									
1.5.2 People, external									
1.5.3 People, ingestion									

COST DESCRIPTION--ALTERNATIVE COOLING SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									
1.7 Plant construction (including site preparation)									
1.7.1 Water quality, physical									
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Groundwater									
2.1 Raising/lowering of ground water levels									
2.1.1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (excluding salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Radionuclide contamination of ground water									
2.3.1 People									
2.3.2 Plants and animals									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									
3.1.3 Water transportation									

COST DESCRIPTION–ALTERNATIVE COOLING SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									
3.2.2 Air quality, odor									
3.3 Radionuclides discharged to ambient air and direct radiation from radioactive materials (in-plant or being transported)									
3.3.1 People, external									
3.3.2 People, ingestion									
3.3.3 Plants and animals									
3.4 Other impacts on air									
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.5 Land (erosion)									
4.3 Plant operation									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									

COST DESCRIPTION–ALTERNATIVE COOLING SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A		B		C		D	
		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
4.4.3 Property resources									
4.5 Not applicable									
4.6 Not applicable									
4.7 Not applicable									
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION—ALTERNATIVE COOLING INTAKE SYSTEMS

	ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST	Present Worth								
	Annualized								
CAPACITY FACTOR									
ENVIRONMENTAL COSTS	UNITS	Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
1. Natural Surface Water Body									
1.1 Impingement or entrapment by cooling water intake structure									
1.1.1 Fish									
1.2 Passage through or retention in cooling systems									
1.2.1 Phytoplankton and zooplankton									
1.2.2 Fish									
1.3 Discharge area and thermal plume									
1.3.1 Water quality, excess heat									
1.3.2 Water quality, oxygen availability									
1.3.3 Aquatic organisms									
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.3.5 Fish, migratory									
1.4 Chemical effluents									
1.4.1 Water quality, chemical									
1.4.2 Aquatic organisms									
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.4.4 People									
1.5 Not applicable									
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									
1.7 Plant construction (including site preparation									
1.7.1 Water quality, physical									

COST DESCRIPTION—ALTERNATIVE COOLING INTAKE SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.1 Raising/lowering of ground water levels									
2.1.1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (excluding salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Not applicable									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									
3.1.3 Water transportation									
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									
3.2.2 Air quality, odor									
3.4 Other impacts on air									

COST DESCRIPTION—ALTERNATIVE COOLING INTAKE SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.4 Wildlife									
4.2.5 Land (erosion)									
4.3 Plant operation									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									
4.5 Not applicable									
4.6 Not applicable									
4.7 Not applicable									
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION—ALTERNATIVE COOLING DISCHARGE SYSTEM

	ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST	Present Worth								
	Annualized								
CAPACITY FACTOR									
ENVIRONMENTAL COSTS	UNITS	Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
1. Natural Surface Water Body									
1.1 Impingement or entrapment by cooling water intake structure									
1.1.1 Fish									
1.2 Passage through or retention in cooling systems									
1.2.1 Phytoplankton and zooplankton									
1.2.2 Fish									
1.3 Discharge area and thermal plume									
1.3.1 Water quality, excess heat									
1.3.2 Water quality, oxygen availability									
1.3.3 Aquatic organisms									
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.3.5 Fish, migratory									
1.4 Chemical effluents									
1.4.1 Water quality, chemical									
1.4.2 Aquatic organisms									
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.4.4 People									
1.5 Not applicable									
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									
1.7 Plant construction (including site preparation									
1.7.1 Water quality, physical									

COST DESCRIPTION–ALTERNATIVE COOLING DISCHARGE SYSTEM (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.1 Raising/lowering of ground water levels									
2.1.1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (excluding salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Not applicable									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									
3.1.3 Water transportation									
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									
3.2.2 Air quality, odor									
3.4 Other impacts on air									

COST DESCRIPTION—ALTERNATIVE COOLING DISCHARGE SYSTEM (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.4 Wildlife									
4.2.5 Land (erosion)									
4.3 Plant operation									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									
4.5 Not applicable									
4.6 Not applicable									
4.7 Not applicable									
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION–ALTERNATIVE CHEMICAL SYSTEMS

		ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST		Present Worth								
		Annualized								
CAPACITY FACTOR										
ENVIRONMENTAL COSTS	UNITS		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
CHEMICAL SPECIES DISCHARGED (LIST BELOW) (indicate concentrations at point of discharge)										
1. Natural Surface Water Body										
1.1 Impingement or entrapment by cooling water intake structure										
1.1.1 Fish										
1.2 Passage through or retention in cooling systems										
1.2.1 Phytoplankton and zooplankton										
1.2.2 Fish										
1.3 Discharge area and thermal plume										
1.3.1 Water quality, excess heat										
1.3.2 Water quality, oxygen availability										
1.3.3 Aquatic organisms										
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)										
1.3.5 Fish, migratory										
1.4 Chemical effluents										
1.4.1 Water quality, chemical										
1.4.2 Aquatic organisms										

COST DESCRIPTION–ALTERNATIVE CHEMICAL SYSTEMS (continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.4.4 People									
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									
1.7 Plant construction (including site preparation)									
1.7.1 Water quality, physical									
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.1 Raising/lowering of ground water levels									
2.1.1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (excluding salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Not applicable									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									

COST DESCRIPTION–ALTERNATIVE CHEMICAL SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A		B		C		D	
		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
3.1.3 Water transportation									
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									
3.2.2 Air quality, odor									
3.3 Not applicable									
3.4 Other impacts on air									
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.4 Wildlife									
4.2.5 Land (erosion)									
4.3 Plant operation (including site preparation)									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									
4.4.3 Property resources									

COST DESCRIPTION–ALTERNATIVE CHEMICAL SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION—ALTERNATIVE BIOCIDE SYSTEMS

		ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST		Present Worth								
		Annualized								
CAPACITY FACTOR										
ENVIRONMENTAL COSTS	UNITS		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
CHEMICAL SPECIES DISCHARGED (LIST BELOW) (indicate concentrations at point of discharge)										
1. Natural Surface Water Body										
1.1 Impingement or entrapment by cooling water intake structure										
1.1.1 Fish										
1.2 Passage through or retention in cooling systems										
1.2.1 Phytoplankton and zooplankton										
1.2.2 Fish										
1.3 Discharge area and thermal plume										
1.3.1 Water quality, excess heat										
1.3.2 Water quality, oxygen availability										
1.3.3 Aquatic organisms										
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)										
1.3.5 Fish, migratory										
1.4 Chemical effluents										
1.4.1 Water quality, chemical										
1.4.2 Aquatic organisms										

COST DESCRIPTION–ALTERNATIVE BIOCIDE SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.4.4 People									
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									
1.7 Plant construction (including site preparation)									
1.7.1 Water quality, physical									
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.1 Raising/lowering of ground water levels									
2.1:1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (excluding salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Not applicable									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									

COST DESCRIPTION–ALTERNATIVE BIOCIDE SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A		B		C		D	
		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
3.1.3 Water transportation									
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									
3.2.2 Air quality, odor									
3.3 Not applicable									
3.4 Other impacts on air									
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.4 Wildlife									
4.2.5 Land (erosion)									
4.3 Plant operation (including site preparation)									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									
4.4.3 Property resources									

COST DESCRIPTION–ALTERNATIVE BIOCIDE SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A		B		C		D	
		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION–ALTERNATIVE SANITARY WASTE SYSTEM

	ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST	Present Worth								
	Annualized								
CAPACITY FACTOR									
ENVIRONMENTAL COSTS	UNITS	Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
CHEMICAL SPECIES DISCHARGED (LIST BELOW) (indicate concentrations at point of discharge)									
1. Natural Surface Water Body									
1.1 Impingement or entrapment by cooling water intake structure									
1.1.1 Fish									
1.2 Passage through or retention in cooling systems									
1.2.1 Phytoplankton and zooplankton									
1.2.2 Fish									
1.3 Discharge area and thermal plume									
1.3.1 Water quality, excess heat									
1.3.2 Water quality, oxygen availability									
1.3.3 Aquatic organisms									
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.3.5 Fish, migratory									
1.4 Chemical effluents									
1.4.1 Water quality, chemical									
1.4.2 Aquatic organisms									

COST DESCRIPTION–ALTERNATIVE SANITARY WASTE SYSTEM (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.4.4 People									
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									
1.7 Plant construction (including site preparation)									
1.7.1 Water quality, physical									
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.1 Raising/lowering of ground water levels									
2.1.1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (excluding salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Not applicable									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									

COST DESCRIPTION—ALTERNATIVE SANITARY WASTE SYSTEM (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
3.1.3 Water transportation									
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									
3.2.2 Air quality, odor									
3.3 Not applicable									
3.4 Other impacts on air									
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.4 Wildlife									
4.2.5 Land (erosion)									
4.3 Plant operation (including site preparation)									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									
4.4.3 Property resources									

COST DESCRIPTION–ALTERNATIVE SANITARY WASTE SYSTEM (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION–ALTERNATIVE GASEOUS RADWASTE SYSTEMS

	ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST	Present Worth								
	Annualized								
CAPACITY FACTOR									
ENVIRONMENTAL COSTS	UNITS	Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
RADIONUCLIDES EMITTED (List on separate sheet for each alternative)									
1. Natural Surface Water Body									
1.5 Radionuclides Discharged to Water Body									
1.5.1 Aquatic Organisms									
1.5.2 People, external									
1.5.3 People, ingestion									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.3 Radionuclide contamination of ground water									
2.3.1 People									
2.3.2 Plants and animals									
2.4 Other impacts on ground water									
3. Air									
3.3 Radionuclides discharged to ambient air									
3.3.1 People, external									
3.3.2 People, ingestion									
3.3.3 Plants and animals									
3.4 Other impacts on air									
4. Land									
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

COST DESCRIPTION–ALTERNATIVE LIQUID RADWASTE SYSTEMS

		ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST		Present Worth								
		Annualized								
CAPACITY FACTOR										
ENVIRONMENTAL COSTS	UNITS		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
RADIONUCLIDES EMITTED (List on separate sheet for each alternative)										
1. Natural Surface Water Body										
1.5 Radionuclides Discharged to Water Body										
1.5.1 Aquatic Organisms										
1.5.2 People, external										
1.5.3 People, ingestion										
1.8 Other impacts										
1.9 Combined or interactive effects										
1.10 Net effects										
2. Ground Water										
2.3 Radionuclide contamination of ground water										
2.3.1 People										
2.3.2 Plants and animals										
2.4 Other impacts on ground water										
3. Air										
3.3 Radionuclides discharged to ambient air										
3.3.1 People, external										
3.3.2 People, ingestion										
3.3.3 Plants and animals										
3.4 Other impacts on air										
4. Land										
4.8 Other land impacts										
4.9 Combined or interactive effects										
4.10 Net effects										

COST DESCRIPTION–ALTERNATIVE TRANSMISSION ROUTES

		ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST		Present Worth								
		Annualized								
CAPACITY FACTOR										
ENVIRONMENTAL COSTS	UNITS		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
1. Land Use (Rank alternative routes in terms of amount of conflict with present and planned land use)										
2. Property Values (Rank alternative routes in terms of total loss in property values)										
3. Multiple Use (Rank alternative routes in terms of envisioned multiple use of land preempted by rights-of-way)										
4. Length of new rights-of-way required										
5. Number and length of new access and service roads required										
6. Number of major road crossings in vicinity of intersection or interchanges										
7. Number of major waterway crossings										
8. Number of crest, ridge, or other high point crossings										
9. Number of "long views" or transmission lines perpendicular to highways and waterways										
10. Length of above transmission line in or through the following visually sensitive areas										
10.1 Natural water body shoreline										
10.2 Marshland										
10.3 Wildlife refuges										
10.4 Parks										

COST DESCRIPTION–ALTERNATIVE TRANSMISSION ROUTES (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A		B		C		D	
		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
10.5 National and state monuments									
10.6 Scenic areas									
10.7 Recreation areas									
10.8 Historic areas									
10.9 Residential areas									
10.10 National forests and/or heavily timbered areas									
10.11 Shelter belts									
10.12 Steep slopes									
10.13 Wilderness areas									
10.14 [Other sensitive or critical areas, specify]									
10.15									
10.16									
10.17									
10.18									
10.19									
10.20									
10.21 Total length through sensitive areas (sum 10.1–10.20)									
10.22 Total net length through sensitive areas (sum 10.1–10.20 eliminate duplication)									

COST DESCRIPTION–ALTERNATIVE _____ SYSTEMS

	ALTERNATIVES	A		B		C		D	
INCREMENTAL GENERATING COST	Present Worth								
	Annualized								
CAPACITY FACTOR									
ENVIRONMENTAL COSTS	UNITS	Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
1. Natural Surface Water Body									
1.1 Impingement or entrapment by cooling water intake structure									
1.1.1 Fish									
1.2 Passage through or retention in cooling systems									
1.2.1 Phytoplankton and zooplankton									
1.2.2 Fish									
1.3 Discharge area and thermal plume									
1.3.1 Water quality, excess heat									
1.3.2 Water quality, oxygen availability									
1.3.3 Aquatic organisms									
1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)									
1.3.5 Fish, migratory									
1.4 Chemical effluents									
1.4.1 Water quality, chemical									
1.4.2 Aquatic organisms									
1.4.3 Wildlife (including birds, aquatic and amphibious mannals, and repitles)									
1.4.4 People									
1.5 Radionuclides discharged to water body									
1.5.1 Aquatic organisms									
1.5.2 People, external									
1.5.3 People, ingestion									
1.6 Consumptive use (evaporative losses)									
1.6.1 People									
1.6.2 Property									

COST DESCRIPTION–ALTERNATIVE _____SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
1.7 Plant construction (including site preparation)									
1.7.1 Water quality, physical									
1.7.2 Water quality, chemical									
1.8 Other impacts									
1.9 Combined or interactive effects									
1.10 Net effects									
2. Ground Water									
2.1 Raising/lowering of ground water levels									
2.1.1 People									
2.1.2 Plants									
2.2 Chemical contamination of ground water (including salt)									
2.2.1 People									
2.2.2 Plants									
2.3 Radionuclide contamination of ground water									
2.3.1 People									
2.3.2 Plants and animals									
2.4 Other impacts on ground water									
3. Air									
3.1 Fogging and icing (caused by evaporation and drift)									
3.1.1 Ground transportation									
3.1.2 Air transportation									
3.1.3 Water transportation									
3.1.4 Plants									
3.2 Chemical discharge to ambient air									
3.2.1 Air quality, chemical									

COST DESCRIPTION–ALTERNATIVE _____ SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A		B		C		D	
		Magnitude	Page	Magnitude	Page	Magnitude	Page	Magnitude	Page
3.3.2 Air quality, odor									
3.3 Radionuclides discharged to ambient air and direct radiation from radioactive materials (in-plant or being transported)									
3.3.1 People, external									
3.3.2 People, ingestion									
3.3.3 Plants and animals									
3.4 Other impacts on air									
4. Land									
4.1 Site selection									
4.1.1 Land, amount									
4.2 Construction activities (including site preparation)									
4.2.1 People (amenities)									
4.2.2 People (accessibility of historical sites)									
4.2.3 People (accessibility of archeological sites)									
4.2.4 Wildlife									
4.2.5 Land (erosion)									
4.3 Plant operation									
4.3.1 People (amenities)									
4.3.2 People (aesthetics)									
4.3.3 Wildlife									
4.3.4 Land, flood control									
4.4 Salts discharged from cooling towers									
4.4.1 People									
4.4.2 Plants and animals									
4.4.3 Property resources									

COST DESCRIPTION–ALTERNATIVE_____SYSTEMS (Continued)

ENVIRONMENTAL COSTS	UNITS	ALTERNATIVES A Magnitude	A Page	B Magnitude	B Page	C Magnitude	C Page	D Magnitude	D Page
4.5 Transmission route selection									
4.5.1 Land, amount									
4.5.2 Land use and land value									
4.5.3 People (aesthetics)									
4.6 Transmission facilities construction									
4.6.1 Land adjacent to right-of-way									
4.6.2 Land, erosion									
4.6.3 Wildlife									
4.7 Transmission line operation									
4.7.1 Land use									
4.7.2 Wildlife									
4.8 Other land impacts									
4.9 Combined or interactive effects									
4.10 Net effects									

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

(As revised September 9, 1971 and further amendments of September 30, 1971, November 11, 1971, and January 20, 1972 - with corrections dated September 21, 1971 and December 16, 1971.)

APPENDIX D—INTERIM STATEMENT OF GENERAL POLICY AND PROCEDURE: IMPLEMENTATION OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (PUBLIC LAW 91-190)

INTRODUCTION

On July 23, 1971, the U.S. Court of Appeals for the District of Columbia Circuit rendered its decision in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al., Nos. 24,839 and 24,871, holding that Atomic Energy Commission regulations for the implementation of the National Environmental Policy Act of 1969 (NEPA) in AEC licensing proceedings did not comply in several specified respects with the dictates of that Act, and remanding the proceedings to the Commission for rule making consistent with the court's opinion.

The Court of Appeals' decision required, in summary, that the Commission's rules make provision for the following:

1. Independent substantive review of environmental matters in uncontested as well as contested cases by presiding Atomic Safety and Licensing Boards.

2. Consideration of NEPA environmental issues in connection with all nuclear power reactor licensing actions which took place after January 1, 1970 (the effective date of NEPA).

3. Independent evaluation and balancing of certain environmental factors, such as thermal effects, notwithstanding the fact that other Federal or State agencies have already certified that their own environmental standards are satisfied by the proposed licensing action. In each individual case, the benefits of the licensing action must be assessed and weighed against environmental costs; and alternatives must be considered which would affect the balancing of values.

4. NEPA review, and appropriate action after such review, for construction permits issued prior to January 1, 1970, in cases where an operating license has not as yet been issued. The court's opinion also states that, in order that this review be as effective as possible, the Commission should consider the requirement of a temporary halt in construction pending its review and the backfitting of technological innovations.

As summary background, the National Environmental Policy Act of 1969 (Public Law 91-190) became effective on January 1, 1970. The Commission published on April 2, 1970, in its initial implementation of the Act, an Appendix D to Part 50 stating general Commission policy and procedure for exercising AEC responsibilities under the Act in its licensing proceedings (35 F.R. 5463). Substantial amendments to Appendix D were published on December 4, 1970 (35 F.R. 18469), and further minor amendments on July 7, 1971 (36 F.R. 12731).

The amendments to Appendix D issued herewith have been adopted by the Commission to make interim changes in its regulations for implementation of NEPA in AEC licensing proceedings in light of the Court of Appeals' decision.

A. *Basic procedures.* 1. Each applicant [1] for a permit to construct a nuclear power reactor, testing facility, or fuel reprocessing plant, or such other production or utilization facility whose construction or operation may be determined by the Commission to have a significant impact on the environment, shall submit with his application three hundred (300) copies, in the case of a nuclear power reactor, testing facility, or fuel reprocessing plant, or two hundred (200) copies, in the case of such other production or utilization facility, of a separate document, entitled "Applicant's Environmental Report—Construction Permit Stage," which discusses the following environmental considerations:

(a) The environmental impact of the proposed action,

(b) Any adverse environmental effects which cannot be avoided should the proposal be implemented,

(c) Alternatives to the proposed action,

(d) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(e) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

2. The discussion of alternatives to the proposed action in the Environmental Report required by paragraph 1 shall be sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102 (2) (D) of the National Environmental Policy Act, "appropriate alternatives • • • in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

3. The Environmental Report required by paragraph 1 shall include a cost-benefit analysis which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental, economic, technical and other benefits of the facility. The cost-benefit analysis shall, to the fullest extent practicable, quantify the various factors considered. To the extent that such factors cannot be quantified, they shall be discussed in qualitative terms. The Environmental Report should contain sufficient data to aid the Commission in its development of an independent cost-benefit analysis covering the factors specified in this paragraph.

4. The Environmental Report required by paragraph 1 shall include a discussion of the status of compliance of the facility with applicable environmental quality standards and requirements (including, but not limited to, thermal and other water quality standards promulgated under the Federal Water Pollution Control Act) which have been imposed by Federal, State, and regional agencies having responsibility for environmental protection. In addition, the environmental impact of the facility shall be fully discussed with respect to matters covered by such standards and requirements irrespective of whether a certification from the appropriate authority has been obtained (including, but not limited to, any certification obtained pursuant to section 21(b) of the Federal Water Pollution Control Act [2]). Such discussion shall be reflected in the cost-benefit analysis prescribed in paragraph 3. While satisfaction of AEC standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis prescribed in paragraph 3 shall, for the purposes of the National Environmental Policy Act, consider the radiological effects, together with the thermal effects and the other environmental effects, of the facility.

5. Each applicant for a license to operate a production or utilization facility described in paragraph 1, shall submit with his application three hundred (300) copies, in the case of a nuclear power reactor, testing facility, or fuel reprocessing plant, or two hundred (200) copies, in the case of any other production or utilization facility described in paragraph 1, of a separate document, to be entitled "Applicant's Environmental Report—Operating License Stage," which discusses the same environmental considerations described in paragraphs 1–4, but only to the extent that they differ from those discussed in the Applicant's Environmental Report previously submitted in accordance with paragraph 1. The "Applicant's Environmental Report—Operating License Stage" may incorporate by reference any information contained in the Applicant's Environmental Report previously submitted in accordance with paragraph 1. With respect to the operation of nuclear power reactors, the applicant, unless otherwise required by the Commission, shall submit the "Applicant's Environmental Report—Operating License Stage" only in connection with the first licensing action that would authorize full-power operation of the facility,[3] except that such report shall be submitted in connection with the conversion of a provisional operating license to a full-term license.

6. After receipt of any Applicant's Environmental Report, the Director of Regulation or his designee will cause to be published in the FEDERAL REGISTER a summary notice of the availability of the report, and the report will be placed in the AEC's Public Document Rooms at 1717 H Street NW., Washington, DC, and in the vicinity of the proposed site, and will be made available to the public at

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[1] Where the "applicant", as used in this appendix, is a Federal agency, different arrangements for implementing the National Environmental Policy Act may be made, pursuant to the guidelines established by the Council on Environmental Quality.

[2] No permit or license will, of course, be issued with respect to an activity for which a certification required by section 21(b) of the Federal Water Pollution Control Act has not been obtained.

[3] This report is in addition to the report required at the construction permit stage.

the appropriate State, regional, and metropolitan clearinghouses.[4] In addition, a public announcement of the availability of the report will be made. Any comments by interested persons on the report will be considered by the Commission's regulatory staff, and there will be further opportunity for public comment in accordance with paragraph 7. The Director of Regulation or his designee will analyze the report and prepare a draft detailed statement of environmental considerations. The draft detailed statement will contain an assessment of the matters specified in paragraph 1; a preliminary cost-benefit analysis based on the factors specified in paragraph 3; and an analysis, pursuant to section 102(2)(D) of the National Environmental Policy Act, of appropriate alternatives to the proposed licensing action in any case which involves unresolved conflicts concerning alternative uses of available resources (i.e., an analysis of alternatives which would alter the environmental impact and the cost-benefit balance). The Commission will then transmit a copy of the report and of the draft detailed statement to such Federal agencies designated by the Council on Environmental Quality as having "jurisdiction by law or special expertise with respect to any environmental impact involved" or as "authorized to develop and enforce environmental standards" as the Commission determines are appropriate,[5] and to the Governor or appropriate State and local officials, who are authorized to develop and enforce environmental standards, of any affected State. The transmittal will request comment on the report and the draft detailed statement within forty-five (45) days in the case of Federal agencies and seventy-five (75) days in the case of State and local officials, or within such longer time as the Commission may deem appropriate. (In accordance with § 2.101 (b) of Part 2, the Commission will also send a copy of the application to the Governor or other appropriate official of the State in which the facility is to be located and will publish in the FEDERAL REGISTER a notice of receipt of the application, stating the purpose of the application and specifying the location at which the proposed activity will be conducted.) Comments on an "Applicant's Environmental Report—Operating License Stage" and on the draft detailed statement prepared in connection therewith will be requested only as to environmental matters that differ from those previously considered at the construction permit stage. If any such Federal agency or State or local official fails to provide the Commission with comments within the time specified by the Commission, it will be presumed that the agency or official has no comment to make, unless a specific extension of time has been requested.

7. In addition, upon preparation of a draft detailed statement, the Commission will cause to be published in the FEDERAL REGISTER a summary notice of the availability of the Applicant's Environmental Report and the draft detailed statement. The summary notice to be published pursuant to this paragraph will request, within seventy-five (75) days or such longer period as the Commission may determine to be practicable, comment from interested persons on the proposed action and on the draft statement. The summary notice will also contain a statement to the effect that the comments of Federal agencies and State and local officials thereon will be available when received.[6]

8. After receipt of the comments requested pursuant to paragraphs 6 and 7, the Director of Regulation or his designee will prepare a final detailed statement on the environmental considerations specified in paragraph 1, including a discussion of problems and objections raised by Federal, State, and local agencies or officials and private organizations and individuals and the disposition thereof. The detailed statement will contain a final cost-benefit analysis which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental, economic, technical, and other benefits of the facility. The cost-benefit analysis will, to the fullest extent practicable, quantify the various factors considered. To the extent that such factors cannot be quantified, they will be discussed in qualitative terms. In the case of any proposed licensing action that involves unresolved conflicts concerning alternative uses of available resources, the Detailed Statement will contain an analysis, pursuant to section 102(2)(D) of the National Environmental Policy Act, of alternatives to the proposed licensing action which would alter the environmental impact and the cost-benefit balance. Compliance of facility construction or operation with environmental quality standards and requirements (including, but not limited to, thermal and other water quality standards promulgated under the Federal Water Pollution Control Act) which have been imposed by Federal, State and regional agencies having responsibility for environmental protection will receive due consideration. In addition, the environmental impact of the facility will be considered in the cost-benefit analysis with respect to matters covered by such standards and requirements, irrespective of whether a certification from the appropriate authority has been obtained (including, but not limited to, any certification obtained pursuant to section 21(b) of the Federal Water Pollution Control Act[7]). While satisfaction of AEC standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis will, for the purposes of the National Environmental Policy Act, consider the radiological effects, together with the thermal effects and the other environmental effects of the facility.

On the basis of the foregoing evaluations and analyses, the detailed statement will include a conclusion by the Director of Regulation or his designee as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is issuance or denial of the proposed permit or license or its appropriate conditioning to protect environmental values.

Detailed statements prepared in connection with an application for an operating license will cover only environmental considerations which differ from those discussed in the detailed statement previously prepared in connection with the application for a construction permit and may incorporate by reference any information contained in the detailed statement previously prepared in connection with the application for a construction permit. With respect to the operation of nuclear power reactors it is expected that in most cases the detailed statement will be prepared only in connection with the first licensing action that authorizes full-power operation of the facility,[8] except that such a detailed statement will be prepared in connection with the conversion of a provisional operating license to a full-term license.

9. The Commission will transmit to the Council on Environmental Quality copies of (a) each Applicant's Environmental Report, (b) each draft detailed statement, (c) comments thereon received from Federal, State, and local agencies and officials and private organizations and individuals, and (d) each detailed statement prepared pursuant to paragraph 8. Copies of such report, draft statements, comments and statements will be made available to the public as provided in this appendix and as provided in 10 CFR Part 9[9] and will accompany the application through, and will be considered in, the Commission's review processes. After each detailed statement becomes available, a notice of its availability will be published in the FEDERAL REGISTER, and copies will be made available to appropriate Federal, State and local agencies and State, regional, and metropolitan clearinghouses.[4] To the maximum extent practicable, no construction permit or operating license in connection with which a detailed statement is required by paragraph 8 will be issued until ninety (90) days after the draft detailed statement so required has been circulated for comment, furnished to the Council on Environmental Quality, and made available to the public, and until thirty (30) days after the final detailed statement therefor has been made available to the Council and the public. If the final detailed statement is filed within ninety (90) days after a draft statement has been circulated for comment, furnished to the Council and made available to the public, the thirty (30) day period and ninety (90) day period may run concurrently to the extent that they overlap. In addition, to the maximum extent practicable, the final detailed statement will be publicly available at least thirty (30) days before the commencement of any related evidentiary hearing that may be held.

10. In a proceeding for the issuance of a construction permit or an operating license for a production or utilization facility described in paragraph 1 in which a hearing is held, the Applicant's Environmental Report, comments thereon, and the detailed statement will be offered in evidence. Any party to the proceeding may take a position and offer evidence on environmental aspects of

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[4] Such clearinghouses have been established pursuant to Office of Management and Budget Circular A-95 to provide liaison and coordination between Federal and State, regional or local agencies with respect to Federal programs. The documents will be made available at appropriate State, regional and metropolitan clearinghouses only with respect to proceedings in which the draft detailed statement is circulated after June 30, 1971, in accordance with the "Guidelines on Statements on Proposed Federal Actions Affecting the Environment" of the Council on Environmental Quality (36 F.R. 7724).

[5] Requests for comments on Environmental Reports and draft detailed statements from the Environmental Protection Agency will include a request for comments with respect to water quality aspects of the proposed action for which a certification pursuant to section 21(b) of the Federal Water Pollution Control Act has been issued, and with respect to aspects of the proposed action to which section 309 of the Clean Air Act is applicable.

[6] This paragraph applies only with respect to proceedings in which the draft detailed statement is circulated after June 30, 1971, in accordance with the "Guidelines on Statements on Proposed Federal Actions Affecting the Environment" of the Council on Environmental Quality (36 F.R. 7724).

[7] No permit or license will, of course, be issued with respect to an activity for which a certification required by section 21(b) of the Federal Water Pollution Control Act has not been obtained.

[8] This statement is in addition to the statement prepared at the construction permit stage.

[9] 10 CFR Part 9 implements the Freedom of Information Act, section 552 of title 5 of the United States Code.

the proposed licensing action in accordance with the provisions of Subpart G of 10 CFR Part 2.

11. In a proceeding for the issuance of a construction permit for a production or utilization facility described in paragraph 1, and in a proceeding for the issuance of an operating license in which a hearing is held and matters covered by this appendix are in issue, the Atomic Safety and Licensing Board will (a) determine whether the requirements of section 102(2) (C) and (D) of the National Environmental Policy Act and this appendix have been complied with in the proceeding, (b) decide any matters in controversy among the parties, (c) determine, in uncontested proceedings, whether the NEPA review conducted by the Commission's regulatory staff has been adequate, and (d) independently consider the final balance among conflicting factors contained in the record of the proceeding for the permit or license with a view to determining the appropriate action to be taken.

The Atomic Safety and Licensing Board, on the basis of its conclusions on the above matters, shall determine whether the permit or license should be granted, denied, or appropriately conditioned to protect environmental values. The Atomic Safety and Licensing Board's initial decision will include findings and conclusions which may affirm or modify the contents of the detailed statement described in paragraph 8. To the extent that findings and conclusions different from those in the detailed statement are reached, the detailed statement shall be deemed modified to that extent and, as modified, transmitted to the Council on Environmental Quality and made available to the public pursuant to paragraph 9. If the Commission or the Atomic Safety and Licensing Appeal Board, in a decision on review of the initial decision, reaches conclusions different from the Atomic Safety and Licensing Board with respect to environmental aspects, the detailed statement shall be deemed modified to that extent and, as modified, transmitted to the Council on Environmental Quality and made available to the public pursuant to paragraph 9.

12. The Atomic Safety and Licensing Board, during the course of the hearing on an application for a license to operate a production or utilization facility described in paragraph 1, may authorize, pursuant to § 50.57(c), the loading of nuclear fuel in the reactor core and limited operation within the scope of § 50.57(c), upon compliance with the procedures described therein. Where any party to the proceeding opposes such authorization on the basis of matters covered by this appendix, the provisions of paragraph 11 shall apply in regard to the Atomic Safety and Licensing Board's determination of such matters. Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility, and any license issued will be conditioned to that effect.

13. The Commission will incorporate in all construction permits and operating licenses for production and utilization facilities described in paragraph 1, a condition, in addition to any conditions imposed pursuant to paragraph 11, to the effect that the licensee shall observe such standards and requirements for the protection of the environment as are validly imposed pursuant to authority established under Federal and State law and as are determined by the Commission to be applicable to the facility that is subject to the licensing action involved. This condition will not apply to radiological effects since radiological effects are dealt with in other provisions of the construction permit and operating license.

14. The Commission has determined that the following activities subject to materials licensing may also significantly affect the quality of the environment:[10] (a) Licenses for possession and use of special nuclear material for processing and fuel fabrication, scrap recovery and conversion of uranium hexafluoride; (b) licenses for possession and use of source material for uranium milling and production of uranium hexafluoride; and (c) licenses authorizing commercial radioactive waste disposal by land burial. Applicants for such licenses shall submit two hundred (200) copies of an Environmental Report which discusses the environmental considerations described in paragraphs 1–4. Except as the context may otherwise require, procedures and measures similar to those described in Sections A, B, D, and E of this appendix will be followed in proceedings for the issuance of such licenses. The procedures and measures to be followed with respect to materials licenses will, of course, reflect the fact that, unlike the licensing of production and utilization facilities, the licensing of materials does not require separate authorizations for construction and operation. Ordinarily, therefore, there will be only one Applicant's Environmental Report required and only one detailed statement prepared in connection with an application for a materials license. If a proposed subsequent licensing action involves environmental considerations which differ significantly from those discussed in the Environmental Report filed and the detailed statement previously prepared in connection with the original licensing action, a supplementary detailed statement will be prepared. In a proceeding for the issuance of a materials license within the purview of this paragraph where the requirements of paragraphs 1–9 have not as yet been met, the activity for which the license is sought may be authorized with appropriate limitations, upon a showing that the conduct of the activity, so limited, will not have a significant, adverse impact on the quality of the environment. In addition, the Commission recognizes that there may be other circumstances where, consistent with appropriate regard for environmental values, the conduct of such activities may be warranted during the period of the ongoing NEPA environmental review. Accordingly, the activity for which the license is sought may be authorized with appropriate limitations after consideration and balancing of the factors described below: *Provided, however,* That such activity may not be authorized for a period in excess of four (4) months except upon specific prior approval of the Commission. Such approval will be extended only for good cause shown.

FACTORS

(a) Whether it is likely that the activity conducted during the prospective review period will give rise to a significant, adverse impact on the environment; the nature and extent of such impact, if any, and whether redress of any such adverse environmental impact can reasonably be effected should modification or termination of the license result from the ongoing NEPA environmental review.

(b) Whether the activity conducted during the prospective review period would foreclose subsequent adoption of alternatives in the conduct of the activity of the type that could result from the ongoing NEPA environmental review.

(c) The effect of delay in the conduct of the activity upon the public interest. Of primary importance under this criterion are the needs to be served by the conduct of the activity; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the activity, and any license issued will be conditioned to that effect.

B. Procedures for review of certain licenses to construct or operate production or utilization facilities and certain licenses for source material, special nuclear material and byproduct material issued in the period January 1, 1970–September 9, 1971.

1. All holders of (a) construction permits or operating licenses for production or utilization facilities of the type described in section A.1, (b) licenses for possession and use of special nuclear material for processing and fuel fabrication, scrap recovery and conversion of uranium hexafluoride, (c) licenses for possession and use of source material for uranium milling and production of uranium hexafluoride, and (d) licenses authorizing commercial radioactive waste disposal by land burial, issued during the period January 1, 1970—September 9, 1971,[9] shall submit, as soon as possible, but no later than (sixty (60) days after September 9, 1971, or such later date as may be approved by the Commission upon good cause shown, the appropriate number of copies of an Environmental Report as specified in section A 1–5.

If an Environmental Report had been submitted prior to the issuance of the permit or license, a supplement to that report, covering the matters described in section A 1 5 to the extent not previously covered, may be submitted in lieu of a new Environmental Report.

2. After receipt of any Environmental Report or any supplement to an Environmental Report submitted pursuant to paragraph 1 of this section, the procedures set out in section A 6–9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials and interested persons on Environmetal Reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials, or persons, it will be presumed that such agencies, officials or persons have no comments to make. The detailed statement (or supplemental detailed statement, as appropriate) prepared by the Director of Regulation or his designee pursuant to section A 8 mill, on the basis of the analyses and evaluations described therein, include a conclusion by the Director of Regulation or his designee as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is continuation, modification or termination of the permit or license or its appropriate conditioning to protect environmental values.

3. The Director of Regulation will, in the case of a construction permit for a nuclear power or test reactor or a fuel reprocessing plant, publish in the FEDERAL REGISTER a notice of hearing, in accordance with § 2.703 of this chapter, on NEPA environmental issues as defined in section A.11, which hearing notice may be included in the notice required by paragraph 2. With respect to any other permit or license for a facility of a type described in section A.1, the Director of Regulation will publish a notice in the FEDERAL REGISTER, which may be included in the notice required by paragraph 2, providing

[10] Additional activities subject to materials licensing may be determined to significantly affect the quality of the environment and thus be subject to the provisions of this paragraph.

that, within thirty (30) days from the date of publication of the notice, the holder of the permit or license may file a request for a hearing and any person whose interest may be affected by the proceeding may, in accordance with § 2.714 of this chapter, file a petition for leave to intervene and request a hearing. In any hearing held pursuant to this paragraph, the provisions of sections A.10 and 11 will apply. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which proceedings, or any portions thereof, conducted pursuant to this paragraph will be completed.

C. *Procedures for review of certain construction permits for production or utilization facilities issued prior to January 1, 1970, for which operating licenses or notice of opportunity for hearing on the operating license applications have not been issued.* 1. Each holder of a permit to construct a production or utilization facility of the type described in section A.1 issued prior to January 1, 1970, for which neither an operating license nor a notice of opportunity for hearing on the operating license application had been issued prior to October 31, 1971, shall submit the appropriate number of copies of an Environmental report as specified in sections A.1–4 of this appendix as soon as possible, but no later than sixty (60) days after September 9, 1971, or such later date as may be approved by the Commission upon good cause shown. If an environmental report had been submitted prior to September 9, 1971, a supplement to that report, covering the matters described in sections A.1–4 to the extent not previously covered, may be submitted in lieu of a new environmental report.

2. Upon receipt of an Environmental Report or supplemental Environmental Report submitted pursuant to paragraph 1, the procedures set out in section A. 6–9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials, and interested persons on Environmental Reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials or persons, it will be presumed that such agencies, officials or persons have no comment to make. The detailed statement (or supplemental detailed statement, as appropriate) prepared by the Director of Regulation or his designee pursuant to section A.8 will, on the basis of the analyses and evaluations described therein, include a conclusion as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is the continuation, modification or termination of the construction permit or its appropriate conditioning to protect environmental values. Upon preparation of the detailed statement, the Director of Regulation will publish in the FEDERAL REGISTER a notice, which may be included in the notice required by section A.9, setting forth his, or his designee's, conclusion as respects the continuation, modification or termination of the construction permit or its appropriate conditioning to protect environmental values. The Director of Regulation will also publish in the FEDERAL REGISTER a notice, which may be included in the notice setting forth his or his designee's conclusion as respects the continuation, modification or termination of the construction permit or its appropriate conditioning to protect environmental values, providing that within thirty (30) days from the date of its publication, any person whose interest may be affected by the proceeding may, in accordance with § 2.714 of this chapter, file a petition for leave to intervene and request a hearing. In any hearing, the provisions of section A. 10 and 11 will apply to the extent pertinent. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which proceedings, or any portions thereof, conducted pursuant to this paragraph will be conducted.

3. The review of environmental matters conducted in accordance with this section C will not be duplicated at the operating license stage, absent new significant information relevant to these matters.

D. *Procedures applicable to pending hearings or proceedings to be noticed in the near future.* 1. In proceedings in which hearings are pending as of September 9, 1971, or in which a draft or final detailed statement of environmental considerations prepared by the Director of Regulation or his designee has been circulated prior to said date [1] in the case of an application for a construction permit, or in which a notice of opportunity for hearing on the application has been issued prior to October 31, 1971, in the case of an application for an operating license, the presiding Atomic Safety and Licensing Board will, if the requirements of paragraphs 1–9 of section A have not as yet been met, proceed expeditiously with the aspects of the application related to the Commission's licensing requirements under the Atomic Energy Act pending the submission of environmental reports and detailed statements as specified in section A and compliance with other applicable requirements of section A. A supplement to the environmental report, covering the matters described in sections A.1–4 to the extent not previously covered, may be submitted in lieu of a new environmental report. Upon receipt of the supplemental environmental report, the procedures set out in sections A.6–9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials, and interested persons on environmental reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials, or persons, it will be presumed that such agencies, officials, or persons have no comment to make. In any subsequent session of the hearing held on the matters covered by this appendix, the provisions of sections A.10 and 11 will apply to the extent pertinent. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which the proceeding, or any portion thereof, will be completed.

2. In a proceeding for the issuance of an operating license where the requirements of paragraphs 1–9 of section A have not as yet been met and the matter is pending before an Atomic Safety and Licensing Board, the applicant may make, pursuant to § 50.57(c), a motion in writing for the issuance of a license authorizing the loading of fuel in the reactor core and limited operation within the scope of § 50.57(c). Upon a showing on the record that the proposed licensing action will not have a significant, adverse impact on the quality of the environment and upon satisfaction of the requirements of § 50.57(c), the presiding Atomic Safety and Licensing Board may grant the applicant's motion. In addition, the Commission recognizes that there may be other circumstances where, consistent with appropriate regard for environmental values, limited operation may be warranted during the period of the ongoing NEPA environmental review. Such circumstances include testing and verification of plant performance and other limited activities where operation can be justified without prejudice to the ends of environmental protection. Accordingly, the presiding Atomic Safety and Licensing Board may, upon satisfaction of the requirements of § 50.57(c), grant a motion, pursuant to that section, after consideration and balancing on the record of the factors described below: *Provided, however*, that operation beyond twenty percent (20%) of full power may not be authorized except upon specific prior approval of the Commission.

FACTORS

(a) Whether it is likely that limited operation during the prospective review period will give rise to a significant, adverse impact on the environment; the nature and extent of such impact, if any; and whether redress of any such adverse environmental impact can reasonably be effected should modification or termination of the limited license result from the ongoing NEPA environmental review.

(b) Whether limited operation during the prospective review period would foreclose subsequent adoption of alternatives in facility design or operation of the type that could result from the ongoing NEPA environmental review.

(c) The effect of delay in facility operation upon the public interest. Of primary importance under this criterion are the power needs to be served by the facility; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

If any party, including the staff, opposes the request, the provisions of § 50.57(c) will apply with respect to the resolution of the objections of such party and the making of findings required by § 50.57(c) and this paragraph. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which the proceeding, or any portion thereof, will be completed. Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility, and any license issued will be conditioned to that effect.

3. This paragraph applies to proceedings on an application for an operating license for which a notice of opportunity for hearing was issued prior to October 31, 1971, and no hearing has been requested. In such proceedings an environmental report or a supplement to the environmental report, covering the matters described in sections A.1–4 to the extent not previously covered, shall be submitted. Upon receipt of the supplemental environmental report, the procedures set out in sections A.6–9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials, and interested persons on environmental reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials, or persons, it will be presumed that such agencies, officials, or persons have no comment to make.

In addition to the pertinent provisions of paragraphs 1–9 of section A, the provisions of section B.3 will be followed. If in such proceedings, the requirements of paragraphs 1–9 of section A have not as yet been met, the Commission may issue a license authorizing the loading of fuel in the reactor core and limited operation within the scope of § 50.57(c), upon a showing that such licensing action will not have a significant, adverse impact on the quality of the environment and upon making the appropriate findings on the matters specified in § 50.57(a). In addition, the Commission recognizes that there may be other circumstances where, consistent with appropriate regard for environmental values, limited operation may be warranted during the period of the ongoing NEPA environmental re-

view. Such circumstances include testing and vertification of plant performance and other limited activities where operation can be justified without prejudice to the ends of environmental protection. Accordingly, the Commission may issue a license for limited operation after consideration and balancing of the factors described in paragraph 2, of this section and upon making the appropriate findings on the matters specified in § 50.57(a): *Provided, however,* That operation beyond twenty percent (20%) of full power will not be authorized except in emergency situations or other situations where the public interest so requires. Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility, and any license issued will be conditioned to that effect.

D. *Consideration of suspension of certain permits and licenses pending NEPA Environmental Review.*

1. In regard to (a) proceedings subject to Section B other than those in which a hearing on an operating license application has commenced, (b) proceedings subject to section C involving nuclear power reactors and testing facilities,[12] and (c) proceedings in which the Commission estimates that construction under a permit will not be completed by January 1, 1973, the Commission will consider and determine, in accordance with the provisions of paragraphs 3 and 4 of this section E, whether the permit or license should be suspended, in whole or in part, pending completion of the NEPA environmental review specified in those sections.

2. In making the determination called for in paragraph 1, the Commission will consider and balance the following factors:

(a) Whether it is likely that continued construction or operation during the prospective review period will give rise to a significant adverse impact on the environment; the nature and extent of such impact, if any; and whether redress of any such adverse environmental impact can reasonably be effected should modification, suspension or termination of the permit or license result from the ongoing NEPA environmental review.

(b) Whether continued construction or operation during the prospective review period would foreclose subsequent adoption of alternatives in facility design or operation of the type that could result from the ongoing NEPA environmental review.

(c) The effect of delay in facility construction or operation upon the public interest. Of primary importance under this criterion are the power needs to be served by the facility; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

3. Each holder of a permit or license subject to paragraph 1 of this section E shall furnish to the Commission, before 40 days after September 9, 1971 or such later date as may be approved by the Commission upon good cause shown, a written statement of any reasons, with supporting factual submission, why, with reference to the criteria in paragraph 2, the permit or license should not be suspended, in whole or in part, pending completion of the NEPA environmental review specified in sections B, C, or D. Such documents will be publicly available and any interested person may submit comments thereon to the Commission.

4. The Commission will thereafter determine whether the permit or license shall be suspended pending NEPA environmental review and will publish that determination in the FEDERAL REGISTER. A public announcement of that determination will also be made.

(a) If the Commission determines that the permit or license shall be suspended, an order to show cause pursuant to § 2.202 of this chapter shall be served upon the licensee and the provisions of that section followed.[13]

(b) Any person whose interest may be affected by the proceeding, other than the licensee, may file a request for a hearing within thirty (30) days after publication of the Commission's determination on this matter in the FEDERAL REGISTER. Such request shall set forth the matters, with reference to the criteria set out in paragraph 2, alleged to warrant a suspension determination other than that made by the Commission, and shall set forth the factual basis for the request. If the Commission determines that the matters stated in such request warrant a hearing, a notice of hearing will be published in the FEDERAL REGISTER.

(c) The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which a proceeding, or any portion thereof, conducted pursuant to this paragraph shall be completed.

[11] In proceedings in which an applicant's environmental report, rather than a draft detailed statement, was circulated by the Commission, that environmental report shall be deemed a draft detailed statement for the purposes of this paragraph.

[12] Fuel reprocessing plants have been excluded since only one such plant is subject to section C and its construction is complete.

[13] 10 CFR 2.202 among other things, provides for institution of a proceeding to modify, suspend, or revoke a license by issuance of an order to show cause and provides an opportunity for hearing.

FEDERAL REGISTER, VOL. 36, NO. 175—

THURSDAY, SEPTEMBER 9, 1971

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of National Environmental Policy Act of 1969

On July 23, 1971, the U.S. Court of Appeals for the District of Columbia Circuit rendered its decision in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al. Nos. 24,839 and 24,871, holding that Atomic Energy Commission regulations for the implementation of the National Environmental Policy Act of 1969 (NEPA) in AEC licensing proceedings did not comply in several specified respects with the dictates of that Act, and remanding the proceedings to the Commission for rule making consistent with the Court's opinion.

Revised Appendix D set forth below is an interim statement of Commission policy and procedure for the implementation of NEPA in accordance with the decision of the Court of Appeals.

The effect of the revised regulations will be to make the Atomic Energy Commission directly responsible for evaluating the total environmental impact, including thermal effects, of nuclear power plants, and for assessing this impact in terms of the available alternatives and the need for electric power.

The Commission intends to be responsive to the conservation and environmental concerns of the public. At the same time the Commission is also examining steps that can be taken to reconcile a proper regard for the environment with the necessity for meeting the Nation's growing requirements for electric power on a timely basis.

The procedures in Appendix D apply to licensing proceedings for nuclear power reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

Revised Appendix D is divided into five sections. Section A deals with the basic procedures for implementing NEPA, including an identification of the information required of applicants, the circulation of environmental reports and detailed statements for comment, and the role of Atomic Safety and Licensing Boards in the environmental review process.

Section B deals with procedures applicable to the specified facility and materials licenses issued during the period from January 1, 1970, the date of enactment of NEPA, to the effective date of this revision.

Section C deals with the procedures applicable to construction permits for the specified facilities issued prior to January 1, 1970, for which operating licenses have not been issued.

Section D deals with the procedures applicable to pending hearings and hearings to be conducted in the near future. It makes provision for NEPA review and hearing opportunity on NEPA matters following such review and also provides for possible authorization of fuel loading and limited operation of nuclear power reactors, consistent with appropriate regard for environmental values, during the period of ongoing NEPA environmental review. Operation beyond twenty percent (20%) of full power would require the specific prior approval of the Commission and would not be authorized except in emergency situations or other situations where the public interest so requires. (Counterpart provisions for certain materials licensing actions are contained in section A.)

Section E sets forth the factors which will be considered by the Commission in determining whether to suspend, pending the required NEPA environmental review, permits or licenses of the specified types issued during the period from January 1, 1970, and the effective date of this revision and construction permits for the specified facilities issued prior to January 1, 1970, for which operating licenses have not been issued.

Sections B, C, and D provide that the Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the times within which the proceedings subject to those sections will be completed. These provisions are in keeping with the Commission's continuing objective of minimizing undue delay in the conduct of its licensing proceedings. They would not impinge upon the basic requirements for a fair and orderly hearing on the NEPA issues.

Because the revision of Appendix D which follows is necessary to comply with Court of Appeals' decision in the Calvert Cliffs case, the Commission has found that good cause exists for omitting notice of proposed rule making and public procedure thereon as unnecessary and impracticable and for making the revision effective upon publication in the FEDERAL REGISTER without the customary 30-day notice.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following revision of Appendix D of 10 CFR Part 50 is published as a document subject to codification, to be effective upon publication in the FEDERAL REGISTER (9-9-71).

The Commission invites all interested persons who desire to submit written comments or suggestions for consideration in connection with the revision to send them to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Chief, Public Proceedings Branch, within 60 days after publication of this notice in the FEDERAL REGISTER. Consideration will be given to such submission with the view to possible further amendments. Copies of comments received by the Commission may be examined at the Commission's Public Document Room, 1717 H Street NW., Washington, DC.

Appendix D is revised to read as follows:

FEDERAL REGISTER, VOL. 36, NO. 190—

THURSDAY, SEPTEMBER 30, 1971

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

On September 9, 1971, the Atomic Energy Commission published in the FEDERAL REGISTER (36 F.R. 18071) a revision of Appendix D of its regulation in 10 CFR Part 50, effective on publication. Revised Appendix D as published is an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in accordance with the decision of the U.S. Court of Appeals for the District of Columbia Circuit in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al., Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear power reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

Revised Appendix D is divided into five sections. Section A deals with the basic procedures for implementing NEPA, while sections B, C, and D deal with procedures applicable to certain categories of permits or licenses already issued or for which applications are pending. Section E defines the categories of proceedings in which the Commission will consider and determine whether a permit or license already issued should be suspended pending completion of the NEPA environmental review and sets out the factors to be considered by the Commission in making its determinations.

The Commission has adopted the amendments to revised Appendix D which follow to correct revised Appendix D and clarify the intent of the Commission with respect to proceedings subject to sections C, D, and E.

Section C, *Procedures for review of certain construction permits for production or utilization facilities issued prior to January 1, 1970, for which operating licenses have not been issued*, has been amended to cover such permits issued prior to January 1, 1970 for facilities for which neither an operating license nor a notice of opportunity for hearing on the operating license had been issued prior to September 9, 1971 (the effective date of revised Appendix D). The exclusion of holders of construction permits subject to section D, which is applicable to proceedings in which hearings were pending as of September 9, 1971, or in which a draft or final detailed statement of environmental considerations had been circulated prior to that date, has been deleted. This has the effect of making proceedings such as the Calvert Cliffs proceeding, Dockets Nos. 50-317 and 50-318, subject to sections C and E, as the Commission originally intended.

In section D.1., a footnote has been added to provide that in proceedings in which an applicant's environmental report, rather than a draft detailed statement, was circulated by the Commission that environmental report shall be deemed a draft detailed statement for the purposes of that paragraph.

Section E, which presently applies to proceedings subject to sections B and C, has been amended to apply to (a) proceedings subject to section B other than those in which a hearing on an operating license application has commenced, (b) proceedings subject to section C involving nuclear power reactors and testing facilities, and (c) proceedings in which the Commission estimates that construction under a permit will not be completed by January 1, 1972. This amendment will exclude one fuel reprocessing plant from consideration of suspension pending completion of NEPA environmental review. Since that plant has already been completed, and will be subject to section C procedures before the issuance of an operating license will be considered, no useful purpose would be served by suspension of the construction permit. The amendment will, on the other hand, subject to consideration of suspension, in addition to cases involving nuclear power reactors and testing facilities for which construction permits were issued prior to January 1, 1970, for which operating licenses or notice of opportunity for hearing on the operating license application have not been issued proceedings in which the Commission estimates that construction will not be completed by January 1, 1972, even though a notice of opportunity for hearing on the operating license application or a draft or final detailed statement of environmental considerations has been issued.

Because these amendments relate solely to correction and clarification, the Commission has found that good cause exists for omitting notice of proposed rule making and public procedure thereon as unnecessary. The Commission has also found that since the amendments correct and clarify previous amendments which have already become effective, good cause exists for making the amendments effective without the customary 30-day notice.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of Title 5 of the United States Code, the following amendments to Title 10, Chapter I, Code of Federal Regulations, Part 50, are published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER. (9-30-71):

1. In Appendix D, the phrase "effective date of this amended Appendix D" in sections B and D is changed to read "September 9, 1971" where it appears.

2. Section C.1. of Appendix D is amended to read as follows:

3. A footnote 11 is added to section D.1. of Appendix D following the word "date" to read as follows:

4. Sections E.1. and E.3. of Appendix D are amended to read as follows:

FEDERAL REGISTER, VOL. 36, NO. 218—

THURSDAY, NOVEMBER 11, 1971

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

On September 9, 1971, the Atomic Energy Commission published in the FEDERAL REGISTER (36 F.R. 18071) a revision of Appendix D of its regulation in 10 CFR Part 50, effective on publication. Revised Appendix D as published is an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in accordance with the decision of the U.S. Court of Appeals for the District of Columbia Circuit in "Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al.," Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear power reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

The Commission adopted certain minor amendments to revised Appendix D, published in the FEDERAL REGISTER on September 30, 1971.

The Commission has adopted additional amendments to revised Appendix D that clarify the intent of the Commission with respect to proceedings subject to section D.

In section 4, Procedures Applicable to Pending Hearings or Proceedings to be Noticed in the Near Future, paragraph 1 has been amended to make the provisions of paragraphs 1 and 2 of that section applicable to proceedings in which hearings are pending as of September 9, 1971, or in which a draft or final detailed statement of environmental considerations prepared by the Director of Regulation or his designee has been circulated prior to said date, in the case of an application for a construction permit, or in which a notice of opportunity for hearing on the application has been issued prior to October 31, 1971, in the case of an application for an operating license. A conforming amendment has been made to section C.1 of Appendix D.

Paragraph 3 of section D of Appendix D has been amended to make clear that, in cases where a notice of opportunity for hearing on an operating license application was issued prior to October 31, 1971, and no hearing has been requested, the environmental review procedures set out in section A of Appendix D will, with respect to such proceedings, be subject to the limitation that comments will be requested, and must be received, within 30 days from Federal agencies, State and local officials and interested persons on environmental reports and draft detailed statements. This change conforms paragraph 3 of section D to paragraph 1 of section D in this respect.

Because these amendments relate solely to correction and clarification, the Commission has found that good cause exists for omitting notice of proposed rule making and public procedure thereon as unnecessary. The Commission has also found that since the amendments correct and clarify previous amendments which have already become effective, good cause exists for making the amendments effective without the customary 30 day notice.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendments to Title 10, Chapter I, Code of Federal Regulations, Part 50, are published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER (11-11-71).

In Appendix D, sections C.1, D.1, and D.3 are amended to read as follows:

(Sec. 102, 83 Stat. 853; secs. 3, 161; 68 Stat. 922, 948, as amended; 42 U.S.C. 2013, 2201)

Dated at Germantown, Md., this 29th day of October 1971.

For the Atomic Energy Commission.

W. B. McCOOL,
Secretary of the Commission.

[FR Doc.71-16469 Filed 11-10-71;8:48 am]

FEDERAL REGISTER, VOL. 36, NO. 242—

THURSDAY, DECEMBER 16, 1971

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementations of the National Environmental Policy Act of 1969; Correction

On November 11, 1971, F.R. Doc. 71-16469, amending Appendix D of 10 CFR Part 50, was published in the FEDERAL REGISTER at page 21579. The following correction is made to the amendments to 10 CFR Part 50, Appendix D:

In paragraph 3 in the second column on page 21580, the reference to "§ 50.57 (a)" in the 30th line should read "§ 50.57(c)."

(Sec. 161, 68 Stat. 948; 42 U.S.C. 2201)

Dated at Washington D.C., this 9th day of December 1971.

For the Atomic Energy Commission.

W. B. McCOOL,
Secretary of the Commission.

[FR Doc.71-18402 Filed 12-15-71;8:51 am]

FEDERAL REGISTER, VOL. 36, NO. 218—

THURSDAY, NOVEMBER 11, 1971

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

On September 9, 1971, the Atomic Energy Commission published in the FEDERAL REGISTER (36 F.R. 18071) a revision of Appendix D of its regulation in 10 CFR Part 50, effective on publication. Revised Appendix D as published is an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in accordance with the decision of the U.S. Court of Appeals for the District of Columbia Circuit in "Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al.," Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear power reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

The Commission adopted certain minor amendments to revised Appendix D, published in the FEDERAL REGISTER on September 30, 1971.

The Commission has adopted additional amendments to revised Appendix D that clarify the intent of the Commission with respect to proceedings subject to section D.

In section 4, Procedures Applicable to Pending Hearings or Proceedings to be Noticed in the Near Future, paragraph 1 has been amended to make the provisions of paragraphs 1 and 2 of that section applicable to proceedings in which hearings are pending as of September 9, 1971, or in which a draft or final detailed statement of environmental considerations prepared by the Director of Regulation or his designee has been circulated prior to said date, in the case of an application for a construction permit, or in which a notice of opportunity for hearing on the application has been issued prior to October 31, 1971, in the case of an application for an operating license. A conforming amendment has been made to section C.1 of Appendix D.

Paragraph 3 of section D of Appendix D has been amended to make clear that, in cases where a notice of opportunity for hearing on an operating license application was issued prior to October 31, 1971, and no hearing has been requested, the environmental review procedures set out in section A of Appendix D, will, with respect to such proceedings, be subject to the limitation that comments will be requested, and must be received, within 30 days from Federal agencies, State and local officials and interested persons on environmental reports and draft detailed statements. This change conforms paragraph 3 of section D to paragraph 1 of section D in this respect.

Because these amendments relate solely to correction and clarification, the Commission has found that good cause exists for omitting notice of proposed rule making and public procedure thereon as unnecessary. The Commission has also found that since the amendments correct and clarify previous amendments which have already become effective, good cause exists for making the amendments effective without the customary 30 day notice.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendments to Title 10, Chapter I, Code of Federal Regulations, Part 50, are published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER (11-11-71).

In Appendix D, sections C.1, D.1, and D.3 are amended to read as follows:

(Sec. 102, 83 Stat. 853; secs. 3, 161; 68 Stat. 922, 948, as amended; 42 U.S.C. 2013, 2201)

Dated at Germantown, Md., this 29th day of October 1971.

For the Atomic Energy Commission.

W. B. McCOOL,
Secretary of the Commission.

[FR Doc.71-18469 Filed 11-10-71;8:48 am]

FEDERAL REGISTER, VOL. 36, NO. 242—

THURSDAY, DECEMBER 16, 1971

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementations of the National Environmental Policy Act of 1969; Correction

On November 11, 1971, F.R. Doc. 71-16469, amending Appendix D of 10 CFR Part 50, was published in the FEDERAL REGISTER at page 21579. The following correction is made to the amendments to 10 CFR Part 50, Appendix D:

In paragraph 3 in the second column on page 21580, the reference to "§ 50.57 (a)" in the 30th line should read "§ 50.57(c)."

(Sec. 161, 68 Stat. 948; 42 U.S.C. 2201)

Dated at Washington D.C., this 9th day of December 1971.

For the Atomic Energy Commission.

W. B. McCOOL,
Secretary of the Commission.

[FR Doc.71-18402 Filed 12-15-71;8:51 am]

FEDERAL REGISTER, VOL. 37, NO. 12—

THURSDAY, JANUARY 20, 1972

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

On September 9, 1971, the Atomic Energy Commission published in the FEDERAL REGISTER (36 F.R. 18071) a revision of Appendix D of its regulation in 10 CFR Part 50, effective on publication. Revised Appendix D as published is an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in accordance with the decision of the U.S. Court of Appeals for the District of Columbia Circuit in "Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al.", Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear power reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

The Commission adopted certain minor amendments to revised Appendix D, published in the FEDERAL REGISTER on September 30, 1971, and November 11, 1971.

The Commission has adopted additional amendments to revised Appendix D relating to the procedures for publishing notices of hearing or opportunity for hearing with respect to proceedings subject to sections B, C, and D.

Those sections deal respectively with procedures applicable to certain facility and materials licenses issued during the period from January 1, 1970, the date of enactment of NEPA, to September 9, 1971, with the procedures applicable to construction permits for certain facilities issued prior to January 1, 1970, for which operating licenses or notice of opportunity for hearing on operating license applications have not been issued, and with procedures applicable to pending hearings and hearings to be noticed in the near future.

Under section B, section C, and section D.3 presently in effect, notices of hearing or opportunity for hearing in the licensing proceedings subject to those sections could not be published until the final detailed statement or supplemental detailed statement had been prepared by the Commission's Director of Regulation or his designee. The basic procedures for implementing NEPA in section A of Appendix D, on the other hand, contain no such restriction. Furthermore, the restriction is inconsistent with the Commission's practice of giving early notice of hearing or opportunity for hearing in facility licensing cases—before completion of the reviews of the application by the AEC staff and the Advisory Committee on Reactor Safeguards. That practice results in extra time between the admission of intervening parties and the beginning of the hearing, thus affording a longer period for the preparation of intervenors' cases and avoiding unnecessary delays. Accordingly, the amendments which follow permit, but do not require, the Commission to issue notices of hearing or opportunity for hearing, as appropriate, for the consideration of NEPA environmental issues in such proceedings, before the final detailed statement has been prepared.

Pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendments to Title 10, Chapter 1, Code of Federal Regulations, Part 50, are published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER.

In Appendix D, the sixth sentence in section C.2 is deleted, and section B.3, the fifth sentence in section C.2 and the fifth sentence in section D.3 are amended to read as follows:

FEDERAL REGISTER, VOL. 37, NO. 94—
SATURDAY, MAY 13, 1972

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of National Environmental Policy Act of 1969

On September 9, 1971, the Atomic Energy Commission published in the FEDERAL REGISTER (36 F.R. 18071) a revision of Appendix D of its regulation in 10 CFR Part 50, effective on publication. Revised Appendix D as published is an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in light of the decision of the U.S. Court of Appeals for the District of Columbia Circuit in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al., Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear power reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

Paragraph 13 of section A of Appendix D of Part 50 provides that:

> The Commission will incorporate in all construction permits and operating licenses for production and utilization facilities described in paragraph 1, a condition, in addition to any conditions imposed pursuant to paragraph 11, to the effect that the licensee shall observe such standards and requirements for the protection of the environment as are validly imposed pursuant to authority established under Federal and State law and as are determined by the Commission to be applicable to the facility that is subject to the licensing action involved. This condition will not apply to radiological effects since radiological effects are dealt with in other provisions of the construction permit and operating license.

The central premise of Appendix D prior to its revision in light of the earlier referenced Calvert Cliffs' decision, was the concept that the preservation of environmental values could best be accomplished through the establishment of environmental quality standards and requirements by appropriate Federal, State, and regional agencies having responsibility for environmental protection. The condition referred to was an aspect of NEPA implementation by the Commission reflecting that concept. Since the decision in the Calvert Cliffs' case, the Commission, in compliance with the mandate of the Court of Appeals, has revised its NEPA regulations to provide for an independent review of the environmental impact of the matters covered by such standards and requirements. Accordingly, the condition no longer serves the purpose intended. Any license conditions resulting from the Commission's independent review will be tailored to the particular facility. The Commission has, therefore, revoked paragraph 13 of section A of Appendix D of Part 50 since it is no longer necessary or appropriate. This amendment does not, of course, relieve holders of AEC licenses of any obligation which they otherwise have in regard to applicable standards and requirements imposed by other agencies under Federal or State law.

Because this amendment relates solely to elimination of an obsolete requirement, the Commission has found that good cause exists for omitting notice of proposed rule making and public procedure thereon as unnecessary and for making the amendment effective without the customary 30-day notice.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendment to Title 10, Chapter 1, Code of Federal Regulations, Part 50, is published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER (5-13-72).

In Appendix D, paragraph 13 of section A is revoked.

(Sec. 102, 83 Stat. 853; secs. 3, 161; 68 Stat. 922, 948, as amended; 42 U.S.C. 2013, 2201)

Dated at Germantown, Md., this 8th day of May 1972.

For the Atomic Energy Commission.

W. B. McCOOL,
Secretary of the Commission.

[FR Doc.72-7344 Filed 5-12-72;8:51 am]

FEDERAL REGISTER, VOL. 37, NO. 96—
WEDNESDAY, MAY 17, 1972

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

The Atomic Energy Commission has adopted an amendment to Appendix D of 10 CFR Part 50, an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in accordance with the decision of the U.S. Court of Appeals for the District of Columbia Circuit in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al., Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

In Appendix D, the last sentence of paragraph A.9 provides that, to the maximum extent practicable, the final detailed statement required by NEPA will be publicly available at least thirty (30) days before the commencement of any related evidentiary hearing that may be held. In contrast, the guidelines of the Council on Environmental Quality (CEQ), in paragraph 10(e) of its "Guidelines on Statements on Proposed Federal Actions Affecting the Environment" published April 23, 1971 (36 F.R. 7724), provide that the draft environmental statement should be publicly available at least fifteen (15) days prior to the time of any relevant hearing. The sentence in paragraph A.9 of Appendix D has been amended to conform more closely to the applicable CEQ guideline. This amendment does not, of course, preclude an applicant for a facility construction permit or operating license from presenting its case on environmental matters as well as on radiological health and safety matters prior to the end of the 15-day period. The position of the Commission's regulatory staff will not be presented at any hearing until the final detailed statement is made available.

This amendment is another in a series of amendments which the Commission has adopted or is contemplating in its efforts to establish an effective environmental protection program in the context of a timely decisionmaking process. Recent examples of such amendments are the amendments to Part 50, effective on March 21, 1972 (37 F.R. 5745), limiting site preparation activities that may be performed prior to issuance of a construction permit, and proposed amendments which would restructure the licensing and hearing process published on May 9, 1972 (37 F.R. 9331). The latter amendments would, among other things, provide for earlier and more meaningful participation by the parties to a licensing proceeding.

Since the amendment which follows relates to agency procedures, notice of proposed rule making and public procedure thereon are not required.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendment to Title 10, Chapter 1, Code of Federal Regulations, Part 50, is published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER (5-17-72).

The last sentence of paragraph A.9 of Appendix D is amended to read as follows:

APPENDIX D—INTERIM STATEMENT OF GENERAL POLICY AND PROCEDURE: IMPLEMENTATION OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (PUBLIC LAW 91-190)

* * * * *

A. *Basic procedures.* * * *

9. * * * In addition, the draft detailed statement will be made available to the public at least fifteen (15) days prior to the time of any relevant hearing. At any such hearing, the position of the Commission's regulatory staff will not be presented until the final detailed statement is made available to the public. The foregoing provisions will not preclude an applicant for a facility construction permit or operating license from presenting its case on environmental matters as well as on radiological health and safety matters prior to the end of the fifteen day period.

* * * * *

(Sec. 102, 83 Stat. 853; secs. 3, 161; 68 Stat. 922, 948, as amended; 42 U.S.C. 2013, 2201)

Dated at Germantown, Md., this 15th day of May 1972.

For the Atomic Energy Commission.

W. B. McCool,
Secretary of the Commission.

[FR Doc.72-7551 Filed 5-15-72;12:40 pm]

FEDERAL REGISTER, VOL. 37, NO. 96—
WEDNESDAY, MAY 17, 1972

Title 10—ATOMIC ENERGY

Chapter I—Atomic Energy Commission

PART 50—LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Implementation of the National Environmental Policy Act of 1969

The Atomic Energy Commission has adopted an amendment to Appendix D of 10 CFR Part 50, an interim statement of Commission policy and procedure for the implementation of the National Environmental Policy Act of 1969 (NEPA) in accordance with the decision of the U.S. Court of Appeals for the District of Columbia Circuit in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al., Nos. 24,839 and 24,871. The procedures in Appendix D apply to licensing proceedings for nuclear reactors; testing facilities; fuel reprocessing plants; and other production and utilization facilities whose construction or operation may be determined by the Commission to have a significant impact on the environment. The procedures also apply to proceedings involving certain specified activities subject to materials licensing.

In Appendix D, the last sentence of paragraph A.9 provides that, to the maximum extent practicable, the final detailed statement required by NEPA will be publicly available at least thirty (30) days before the commencement of any related evidentiary hearing that may be held. In contrast, the guidelines of the Council on Environmental Quality (CEQ), in paragraph 10(e) of its "Guidelines on Statements on Proposed Federal Actions Affecting the Environment" published April 23, 1971 (36 F.R. 7724), provide that the draft environmental statement should be publicly available at least fifteen (15) days prior to the time of any relevant hearing. The sentence in paragraph A.9 of Appendix D has been amended to conform more closely to the applicable CEQ guideline. This amendment does not, of course, preclude an applicant for a facility construction permit or operating license from presenting its case on environmental matters as well as on radiological health and safety matters prior to the end of the 15-day period. The position of the Commission's regulatory staff will not be presented at any hearing until the final detailed statement is made available.

This amendment is another in a series of amendments which the Commission has adopted or is contemplating in its efforts to establish an effective environmental protection program in the context of a timely decisionmaking process. Recent examples of such amendments are the amendments to Part 50, effective on March 21, 1972 (37 F.R. 5745), limiting site preparation activities that may be performed prior to issuance of a construction permit, and proposed amendments which would restructure the licensing and hearing process published on May 9, 1972 (37 F.R. 9331). The latter amendments would, among other things, provide for earlier and more meaningful participation by the parties to a licensing proceeding.

Since the amendment which follows relates to agency procedures, notice of proposed rule making and public procedure thereon are not required.

Accordingly, pursuant to the National Environmental Policy Act of 1969, the Atomic Energy Act of 1954, as amended, and sections 552 and 553 of title 5 of the United States Code, the following amendment to Title 10, Chapter 1, Code of Federal Regulations, Part 50, is published as a document subject to codification to be effective upon publication in the FEDERAL REGISTER (5-17-72).

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* * * * *

A. *Basic procedures.* * * *

9. * * * In addition, the draft detailed statement will be made available to the public at least fifteen (15) days prior to the time of any relevant hearing. At any such hearing, the position of the Commission's regulatory staff will not be presented until the final detailed statement is made available to the public. The foregoing provisions will not preclude an applicant for a facility construction permit or operating license from presenting its case on environmental matters as well as on radiological health and safety matters prior to the end of the fifteen day period.

* * * * *

(Sec. 102, 83 Stat. 853; secs. 3, 161; 68 Stat. 922, 948, as amended; 42 U.S.C. 2013, 2201)

Dated at Germantown, Md., this 15th day of May 1972.

For the Atomic Energy Commission.

W. B. McCool,
Secretary of the Commission.

[FR Doc.72-7551 Filed 5-15-72;12:40 pm]

Appendix 2. Questionnaire for Eliciting Data For Radioactive Source-Term Calculation

Pressurized Water Reactors

Basic Data for Source Term Calculation

1. Reactor power (MWt) at which impact is to be analyzed.
2. Weight of U loaded (first loading and equilibrium cycle).
3. Isotopic ratio in fresh fuel (first loading and equilibrium cycle).
4. Expected percentage of leaking fuel.
5. Escape rate coefficients used (or reference).
6. Plant capacity factor (%).
7. Number of steam generators.
8. Type of steam generators (recirculating, once through).
9. Mass of primary coolant in system total (lb) and mass of primary coolant in reactor (lb).
10. Primary coolant flow rate (lb/hr).
11. Mass of steam and mass of liquid in each generator (lb).
12. Total active mass of secondary coolant (lb) (excluding condensate storage tanks).
13. Steam generator operating conditions (temperature °F, pressure psi, flow rate, lb/hr).
14. The number, type and size of condensate demineralizer and total flow rate (lb/hr).
15. What is the containment free volume (ft^3)?
16. What is the expected leak rate of primary coolant to the containment atmosphere (lb/hr)?
17. Is there an internal air cleanup system for iodine in the containment? If so, what volume per unit time is circulated through it? What decontamination factor is expected? How long will the system be operated prior to purging?
18. How often is the containment purged? Is it filtered prior to release? Type of iodine clean up system provided? What decontamination factor is expected?
19. Give the total expected annual average letdown rate during power operation (lb/hr).
    a. What fraction of the letdown is returned to the primary system? How is it treated? What are the expected decontamination factors for removal of principal isotopes?
    b. How is the Li and Cs normally controlled?
    c. What fraction of this goes to boron control system? How is this treated, demineralization, evaporation, filtration?
    d. Is plant design for load follow or base load? What fraction of the letdown stream is diverted to the radwaste system for boron control. How is this treated (demineralization, evaporation, filtration, etc.) and what fraction will be discharged from the plant?
20. What fraction of the letdown stream is stripped of noble gases & iodines? How are these gases collected? What decay do they receive prior to release? Indicate stripping fraction?
21. How are the noble gases and iodines stripped from that portion of the letdown stream which is sent to the boron control system? How are these gases collected? What decay do they receive prior to release?
22. Are the releases from the gaseous waste storage tanks passed through a charcoal absorber? What decontamination factor is expected?
23. How frequently is the system shut down and degassed and by what method? How many volumes of the primary coolant system are degassed in this way each year? What fraction of the gases present are removed? What fraction of other principal nuclides are removed, and by what means? What decay time is provided?
24. Are there any other methods of degassing (i.e., through pressurizer, etc.)? If so describe. How is it treated?
25. What is the expected leak rate of primary coolant to the secondary system (lb/hr)?
26. What is the expected rate of steam generator blowdown (lb/hr) during power operation with the expected leak rate noted in 25. above? Where are the gases from the blowdown vent discharged? Are there charcoal absorbers and/or condensers on the blowdown tank vent? If so, what decontamination factor is expected? How will the blowdown liquid be treated?
27. What is the expected leak rate of steam to the turbine building (lb/hr)? What is the ventilation air flow through the turbine building (cfm)? Where is it discharged? Is the air filtered or treated before discharge? If so, provide expected performance.
28. What is the flow rate (cfm) of gaseous effluent from the main condenser ejector? What treatment is provided? Where is it released?
29. What is the origin of the steam used in the gland seals (i.e., is it primary steam, condensate, or demineralized water from a separate source, etc.)? How is the effluent steam from the gland seals treated and disposed of?
30. What is the expected leak rate of primary coolant to the auxiliary building (lb/hr)? What is the ventilation air flow through the auxiliary building (cfm)?? Where is it discharged? Is the air filtered or

otherwise treated before discharged? If so, provide expected performance.

31. Provide average gallons/day and μCi/cc for following categories of liquid effluents. Use currently observed data in the industry where different from the SAR or Environmental Report (indicate which is used).
    a. High-level wastes (for example, primary coolant let down, "clean" or low conductivity waste, equipment drains and deaerated wastes):
    b. "Dirty" wastes (for example, floor drain wastes, high-conductivity wastes, aerated wastes, and laboratory wastes);
    c. Laundry, decontamination, and wash-down wastes;
    d. Steam generator blowdown–give average flow rate and maximum short-term flows and their duration;
    e. Drains from turbine building;
    f. Frequency of regenerating condensate demineralizers and expected volume of regenerant solutions.

    For these wastes (a-f) provide:
    1. Number and capacity of collector tanks.
    2. Fraction of water to be recycled and factors controlling decision.
    3. Treatment steps–include number, capacity, and process decontamination factor for each principal nuclide for each step. If step is optional, state factors controlling decision.
    4. Decay time from primary loop to discharge.

32. Dilution flow rate for liquid effluents, minimum and normal gpm and total gallons per year.
33. How is waste concentrate (filter cake, demineralizer resin, evaporator bottoms) handled? Give total volume, weight and curies per day or year.
34. Include the expected annual volume of dry waste and curie content of each drum.

Boiling water reactors

Basic Data for Source Term Calculation

1. Reactor power (MWt) and plant capacity factor (%) at which impact is to be analyzed.
2. Weight of U loaded (first loading and equilibrium cycle).
3. Isotopic ratio in fresh fuel (first loading and equilibrium cycle).
4. Expected offgas rate after 30 minutes delay.
5. Escape rate coefficients used (or reference).
6. Primary coolant in system (lb).
    a. Mass of primary coolant in reactor; mass water, mass steam (lb).
    b. Mass of primary coolant in recirculating system (lb).
    c. Fraction of primary coolant in main condenser (lb).
7. Steam conditions at turbine (temp °F, press. psi. flow lb/hr.)
8. Normal recirculation flow rate (lb/hr).
9. Normal clean-up system flow rate (lb/hr). What type of resins are used? What decontamination factors are expected for each principal nuclide? What is the frequency of regeneration and volume of regenerants?
10. Describe and provide the expected performance of the expanded gaseous radwaste treatment system from the main condenser air ejector? Give the expected air in leakage. Is the condenser ejector one stage or two stage? Where is it discharged? How many condenser shells? (If applicable–Pounds of charcoal and operating temperature of)
11. What is the expected leak rate of primary coolant to the dry well (lb/hr)? How frequently is the dry well purged? What treatment is given to this purge and where is it released?
12. What is the expected leak rate of primary coolant (lb/hr) to the reactor building? What is the ventilation air flow through the reactor building (cfm)? Where is it discharged? Is the air filtered or otherwise treated before discharge? If so provide expected performance.
13. What is the expected leak rate of steam (lb/hr) to the turbine building? What is the ventilation air flow through the turbine building (cfm)? Where is it discharged? Is the air filtered or treated before discharge? If so, provide expected performance.
14. Describe the treatment of the exhaust stream from the turbine seal glands.
    a. What is the origin of the steam used in the gland seals? (i.e., is it primary steam condensate, or demineralized water from a separate source, etc.?)
    b. How is the waste stream from the gland seals treated and disposed of?
    c. Indicate how often the mechanical vacuum will be operated and the expected range of activity released.

15. Provide average gallons/day and μCi/cc prior to treatment for the following categories of liquid waste. Use currently observed data in the industry where different from the SAR or Environmental Report (indicate which is used).
    a. High-purity wastes (for example, "clean" or low conductivity waste and equipment drains). Give range of activity expected.
    b. "Dirty" wastes (for example, floor drain wastes, high-conductivity wastes, and laboratory wastes). Give range of activity expected.
    c. Chemical wastes. Give range of activity expected.
    d. Laundry, decontamination, and wash-down wastes. Give range of activity expected.

For these wastes (a-d), provide:

a. Number and capacity of collector tanks.

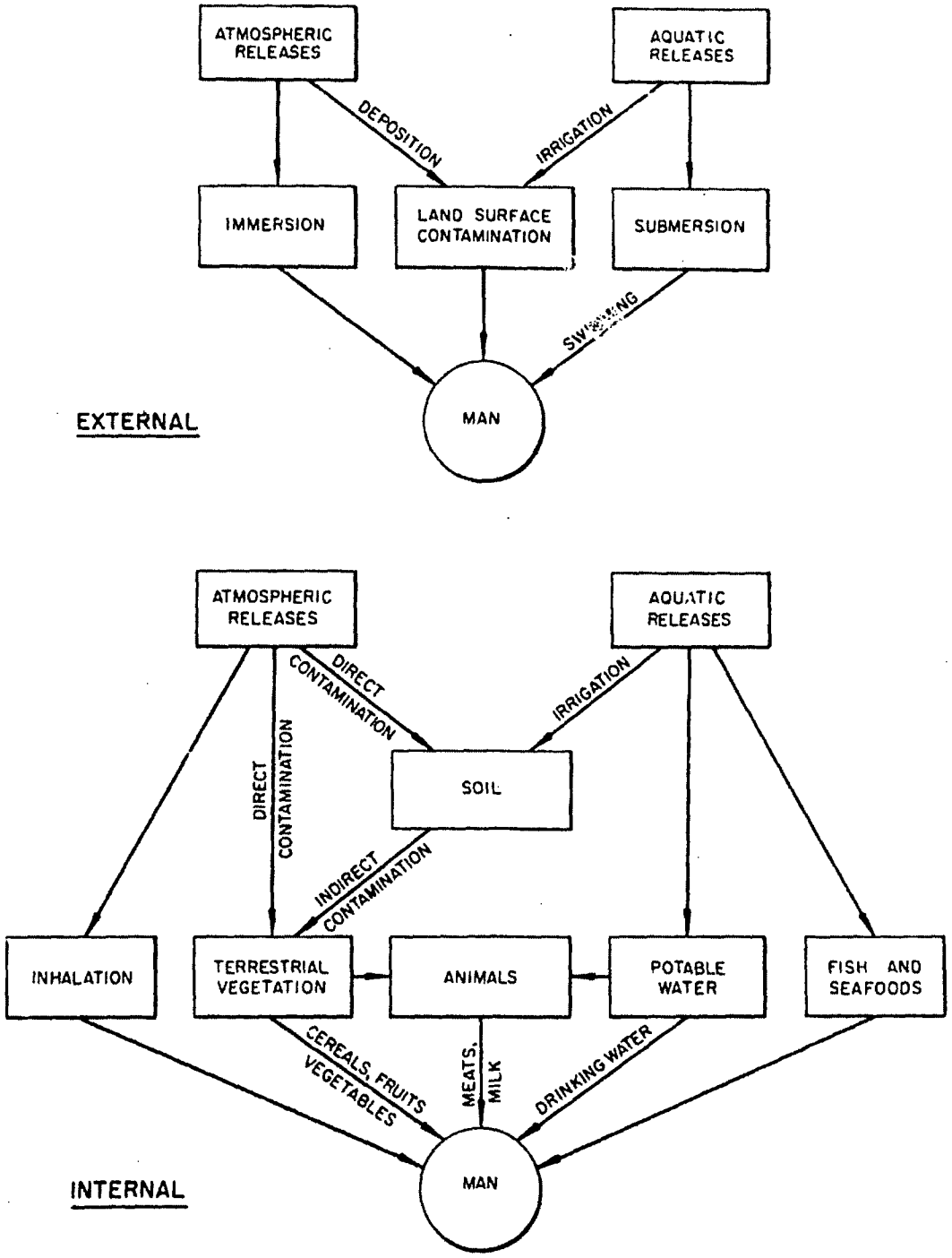
b. Fraction of water to be recycled or factors controlling decision.

c. Treatment steps–include number, capacity, and process D.F. for each principal nuclide for each step. If step is optional, state factors controlling decision.

d. Decay time from primary loop to discharge.

16. For the condensate demineralizers provide the flow rate lb/hr, type of resin used, expected backwash and regeneration frequency, and expected D.F. for each principal nuclide.
17. Dilution flow rate for liquid effluents, minimum and normal gpm and total gallons per year.
18. How is waste concentrate (filter cake, demineralizer resin, evaporator bottoms) handled? Give total volume or weight and curies per day or year. Include the expected annual volume of dry waste and curie content of each drum.

Appendix 3. Example of Chart Showing Radiation Exposure Pathways



(From the Final Environmental Statement related to the operation of Oconee Nuclear Station Units 1, 2, and 3: Docket Nos. 50-269, 50-270, 50-287; March 1972. See page 120 of the Statement.)

Appendix 4. Proposed Appendix I of 10 CFR Part 50

FEDERAL REGISTER, VOL. 36, NO. 111—
WEDNESDAY, JUNE 9, 1971

ATOMIC ENERGY COMMISSION

[10 CFR Part 50]

LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

Light-Water-Cooled Nuclear Power Reactors

The Atomic Energy Commission has under consideration amendments to its regulation, 10 CFR Part 50, "Licensing of Production and Utilization Facilities," which would supplement the regulation with a new Appendix I to that part to provide numerical guides for design objectives and technical specification requirements for limiting conditions for operation for light-water-cooled nuclear power reactors to keep radioactivity in effluents as low as practicable.

On December 3, 1970, the Atomic Energy Commission published in the FEDERAL REGISTER (35 F.R. 18385) amendments to 10 CFR Part 50 that specified design and operating requirements for nuclear power reactors to keep levels of radioactivity in effluents to unrestricted areas as low as practicable. The amendments provided qualitative guidance, but not numerical criteria, for determining when design objectives and operations meet the requirements for keeping levels of radioactivity in effluents as low as practicable.

The Commission noted in the Statement of Considerations published with the amendments the desirability of developing more definitive guidance in connection with the amendments and that it was initiating discussions with the nuclear power industry and other competent groups to achieve that goal.

The Commission considers that the proposed numerical guides for design objectives and technical specification requirements for limiting conditions for operation for light-water-cooled nuclear power reactors set out below would meet the criterion "as low as practicable" for radioactive material in effluents released to unrestricted areas. The guidance would be specifically applicable only to light-water-cooled nuclear power reactors and would not necessarily be appropriate for other types of nuclear power reactors and other kinds of nuclear facilities.

As noted in the Statement of Considerations accompanying the amendments to Part 50 published in the FEDERAL REGISTER on December 3, 1970, the Commission has always subscribed to the general principle that, within established radiation protection guides, radiation exposures to the public should be kept as low as practicable. This general principle has been a central one in the field of radiation protection for many years. Operating licenses include provisions to limit and control radioactive effluents from the plants. Experience has shown that licensees have generally kept exposures to radiation and releases of radioactivity in effluents to levels well below the limits specified in 10 CFR Part 20. Specifically, experience with licensed light-water-cooled nuclear power reactors to date shows that radioactivity in water and air effluents has been kept at low levels—for the most part small percentages of the Part 20 limits. Resultant exposures to the public living in the immediate vicinity of operating power reactors have been small percentages of Federal radiation protection guides.

The Commission also noted that, in general, the release of radioactivity in effluents from nuclear power reactors now in operation have been within ranges that may be considered "as low as practicable," and that, as a result of advances in reactor technology, further reduction of those releases can be achieved. The amendments to Part 50 published on December 3, 1970, were intended to give appropriate regulatory effect, with respect to radioactivity in effluents from nuclear power reactors, to the qualitative guidance of the Federal Radiation Council that radiation doses should be kept "as low as practicable". The proposed guides set out below are intended to provide quantitative guidance to that end for light-water-cooled nuclear power reactors.

The proposed numerical guides are based on present light-water-cooled nuclear power reactor operating experience and state of technology (including recent improvements). In developing the guides the Commission has taken into account comments and suggestions by representatives of power reactor suppliers, electrical utilities, architect-engineering firms, environmental and conservation groups and States in which nuclear power reactors are located on the general subject of definitive guidance for nuclear power reactors. Meetings were held by the Commission with these groups in January and February 1971. The participants in these meetings were provided an opportunity to express their views on the need for more definitive guidance for design objectives for light-water-cooled nuclear power reactors to keep radioactivity in effluents as low as practicable; whether the guidance should be expressed in terms of waste treatment equipment requirements and performance specifications or numerical criteria on quantities and concentrations released to the environment; and to suggest what equipment or numerical criteria would be appropriate at this time.

Generally, the participants favored numerical criteria. Views were expressed that the criteria should be derived from potential doses to people or in the form of quantities and concentrations of radioactive material emitted to the environment. Some opinions were expressed that present technology (including recent improvements) is such that light-water-cooled nuclear power reactors can be designed to keep exposures to the public in the offsite environment within a few percent of exposures from natural background radiation.

The participants also stressed the importance of operating flexibility to take into account unusual conditions of operation which may, on a temporary basis, result in exposures higher than the few percent of natural background radiation, but well within radiation protection guides. Recognition of the need for this operating flexibility is currently stated in § 50.36a(b).

The Commission believes that the proposed guides for design objectives and limiting conditions for operation for light-water-cooled nuclear power reactors set out below provide a reasonable basis at the present time for implementing the principle that radioactive material in effluents released to unrestricted areas should be kept "as low as practicable." As noted in the amendments to Part 50 published on December 3, 1970, "The term 'as low as practicable' as used in this part means as low as is practicably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety and in relation to the utilization of atomic energy in the public interest." The Commission will continue to evaluate the appropriateness of these guides for light-water-cooled nuclear power reactors in light of further operating experience.

Under the President's Reorganization Plan No. 3 of 1970, the Environmental Protection Agency (EPA) is responsible for establishing generally applicable environmental radiation standards for the protection of the general environment from radioactive materials. The AEC is responsible for the implementation and enforcement of EPA's generally applicable environmental standards.

EPA has under consideration generally applicable environmental standards for these types of power reactors. AEC has consulted EPA in the development of the guides on design objectives and limiting conditions for operation set forth below to control radioactivity in effluent releases. If the design objectives and operating limits established herein should prove to be incompatible with any generally applicable environmental standard hereafter established by EPA, the AEC will modify these objectives and limits as necessary.

The proposed guides for design objectives and limiting conditions for operation for light-water-cooled nuclear power reactors are consistent with the basic radiation protection standards and guides recommended by the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP), and the Federal Radiation Council (FRC). (The functions of the FRC were transferred to the Environmental Protection Agency pursuant to Reorganization Plan No. 3 of 1970.) These standards form the basis for the Commission's regulation, 10 CFR Part 20, "Standards for Protection Against Radiation". In this regard, the NCRP announced on January 26, 1971, the release of NCRP Report No. 39, "Basic Radiation Protection Criteria". The NCRP noted that a 10-year study by the

Council has confirmed the validity of most of the basic radiation protection criteria presently used by governmental agencies to regulate the exposure of the population and of radiation workers. The dose limits for individual members of the public remain at 0.5 rem per year and the yearly dose limit of 0.17 rem per person averaged over the population is unchanged. These limits are compatible with the limits and guides recommended by the ICRP and the FRC and apply to exposures from all sources other than medical procedures and natural background.

The NCRP-ICRP-FRC recommended limits and guides give appropriate consideration to the overall requirements of health protection and the beneficial use of radiation and atomic energy. Any biological effects that may occur at the low levels of the limits and guides occur so infrequently that they cannot be detected with existing techniques. The standards setting groups have added to the numerical guidance the general admonition that all radiation exposure should be held to lowest practicable level. This admonition takes into account that generally applicable standards or rules established to cover many situations must necessarily be set at a higher level than may be justified in any given individual situation.

The acceptability of a given level of exposure for a particular activity can be determined only by giving due regard to the reasons for permitting the exposure. This means that, within the basic standards of FRC, NCRP, and ICRP, different limitations on exposure levels are appropriate for various types of activities depending upon the circumstances. A level that is practicable for one type of activity may not be practicable for a different type of activity.

The proposed guides for design objectives and limitations on operations set forth below would be specifically applicable to light-water-cooled nuclear power reactors. Light-water-cooled nuclear power reactors are the only type of power reactors that are being installed in relatively large numbers and on which there is substantial operating experience in the United States. The guides would not necessarily be appropriate for controlling levels of radioactivity in effluents from other types of nuclear power reactors. On the basis of present information on the technology of these other types of reactors, it is expected that releases of radioactivity in effluents can generally be kept within the proposed guides for light-water-cooled nuclear power reactors. The Commission plans to develop numerical guides on levels of radioactivity in effluents that may be considered as low as practicable for other types of nuclear power reactors such as gas cooled and fast breeder reactors as adequate design and operating experience is acquired. In the meantime, design objectives and technical specifications for limiting conditions for operation to carry out the purposes of keeping levels of radioactivity in effluents to unrestricted areas as low as practicable will be specified for other types of nuclear power reactors on a case-by-case basis.

Neither would the guides necessarily be appropriate for controlling levels of radioactivity in effluents from other kinds of nuclear facilities such as fuel reprocessing plants, fuel fabrication plants, or radioisotope processing plants where the design characteristics of the plant and nature of operations involve different considerations. The Commission is giving further consideration to appropriate amendments to its regulations to specify design objectives and limiting conditions for operation to minimize levels of radioactivity released in the operation of other types of licensed facilities such as reactor fuel reprocessing plants.

Expected consequences of guides for design objectives. The proposed guides for design objectives for light-water-cooled nuclear power reactors have been selected primarily on the basis that existing technology makes it feasible to design and operate light-water-cooled nuclear power reactors within the guides. The design objectives are expressed in terms of guides for limiting the number of quantities and for limiting concentrations of radioactive materials in effluents. It is expected that conformance with the guides on design objectives would achieve the following results:

1. Provide reasonable assurance that annual exposures to individuals living near the boundary of a site where one or more light-water-cooled nuclear power reactors are located, from radioactivity released in either liquid or gaseous effluents from all such reactors, will generally be less than about 5 percent of average exposures from natural background radiation.[1] This level of exposure is about 1 percent of Federal radiation protection guides for individual members of the public.

2. Provide reasonable assurance that annual exposures to sizeable population groups from radioactivity released in either liquid or gaseous effluents from all light-water-cooled nuclear power reactors on all sites in the United States for the foreseeable future will generally be less than about 1 percent of exposures from natural background radiation. This level of exposure is also less than 1 percent of Federal radiation protection guides for the average population dose.

These levels of exposure would be indistinguishable from exposures due to variation in natural background radiation, would not be measurable with existing techniques, and would be estimated from effluent data from nuclear power plants by calculational techniques. These levels of exposure are obviously very low in comparison with the much higher exposures incurred by the public from natural background due to cosmic radiation, natural radioactivity in the body and in all materials with which people come into contact, air travel, and from many activities commonly engaged in by the public.

Specific provisions of guides for design objectives. The proposed guides for radioactive materials in liquid effluents would specify limitations on annual total quantities of radioactive material, except tritium, and annual average concentrations of radioactive material in effluent, prior to dilution in a natural body of water, released by each light-water-cooled nuclear power reactor at a site. The release of the concentrations and total quantity of radioactive material from a site at these levels is not likely to result in exposures to the whole body or any organ of an individual in the offsite environment in excess of 5 millirems. In deriving the guides on design objective quantities and concentrations, conservative assumptions have been made on dilution factors, physical, and biological concentration factors in the food chain, dietary intakes and other pertinent factors to relate quantities released to exposures offsite.

The proposed guides for design objectives for radioactive materials in gaseous effluents would limit the total quantity of radioactive material released from a site to the offsite environment so that annual average exposure rates due to noble gases at any location on the boundary of the site or in the offsite environment would not be likely to exceed 10 millirems. Annual average concentrations at any location on the boundary of a site or in the offsite environment from radioactive iodines or radioactive material in particulate form would be limited to specified values.

The proposed guides for design objective concentrations specified for radioactive iodines or radioactive material in particulate form would include a reduction factor of 100,000 for Part 20 concentration values in air that would allow for possible exposures from certain radioactive materials that may be concentrated in the food chain. Resultant exposures to individuals offsite would not be expected to exceed 5 millirems per year. The reduction factor would include a 1,000 factor by which the maximum permissible concentration of radioactive iodine in air should be reduced to allow for the milk exposure pathway. This factor of 1,000 has been derived for radioactive iodine, taking into account the milk pathway. However, it has been arbitrarily applied to radionuclides of iodine and to all radionuclides in particulate form with a half-life greater than 8 days. The factor is not appropriate for iodine where milk is not a pathway of exposure or for other radionuclides under any actual conditions of exposure. The factor is highly conservative for radionuclides other than iodine and is applied only because it appears feasible to meet these very low levels. The specified annual average exposure rates of 10 millirems from noble gases and specified concentrations of radioiodines and particulates at any location on the boundary

[1] Average exposures due to natural background radiation in the United States are in the range of 100–125 millirems per year.

of the site or in the offsite environment provide reasonable assurance that actual annual exposures to the whole body or any organ of an individual member of the public will not exceed 5 millirems.

The proposed guides for design objectives would provide that an applicant for a permit to construct a light-water-cooled nuclear power reactor at a particular site could propose design objective quantities and concentrations in effluents higher than those specified in the guides. The Commission would approve the design objectives if the applicant provided reasonable assurance that, taking into account the environmental characteristics of the site, the concentrations and total quantity of radioactive material released by all light-water-cooled nuclear power reactors at the site in either liquid or gaseous effluents would not result in actual exposures to the whole body or any organ of an individual in the offsite environment in excess of 5 millirems per year.

The proposed guides for design objectives (expressed as quantities and concentrations in effluents) for light-water-cooled nuclear power reactors are sufficiently conservative to provide reasonable assurance that, for most locations having environmental characteristics likely to be considered acceptable by the Commission for a nuclear power reactor site, increases in radiation exposures to individual members of the public living at the site boundary, due to radioactive material in either liquid or gaseous effluents from operation of light-water-cooled nuclear power reactors at the site, will generally be less than 5 millirems per year and average exposures to sizeable population groups will generally be less than 1 millirem per year. Nevertheless, the guides provide that the Commission may specify, as design objectives, quantities and concentrations of radioactive material above background in either liquid or gaseous effluents to be released to unrestricted areas that are lower than the specified quantities and concentrations if it appears that for a particular site the specified quantities and concentrations are likely to result in annual exposures to an individual that would exceed 5 millirems.

Conformance with the proposed guides for design objective quantities and concentrations in effluents would provide reasonable assurance that the resultant whole body dose to the total population exposed would be less than about 400 man-rems [1] per year per 1,000 megawatts electrical installed nuclear generating capacity at a site from radioactive material in liquid and gaseous effluents. Average exposures to large population groups would be less than 1 millirem per year.

Guides on technical specifications limiting conditions for operation. The proposed guidance would include provisions for developing technical specifications with respect to limiting conditions for operation to control radioactivity in effluents from light-water-cooled nuclear power reactors during normal operations. The technical specifications would be included as conditions in operating licenses. These provisions are designed to assure that reasonable efforts are made to keep actual releases of radioactivity in effluents during operation to levels that are within the guides on design objective quantities and concentrations. It is expected that actual levels of radioactivity in effluents will normally be within the design objective levels. It is necessary, however, that nuclear power reactors designed for generating electricity have a high degree of reliability. Operating flexibility is needed to take into account some variation in the small quantities of radioactivity that leak from fuel elements which may, on a transient basis, result in levels of radioactivity in effluents in excess of the design objective quantities and concentrations.

The proposed guidance would provide operating flexibility and at the same time assure a positive system of control, by a graded scale of action by the licensee, to reduce releases of radioactivity if rates of release actually experienced, averaged over any calendar quarter, are such that the quantities or concentrations in effluents would be likely to exceed twice the design objective quantities and concentrations. The proposed Appendix I would provide that the Commission may take appropriate action to assure that release rates are reduced if rates of release of quantities and concentrations in effluents actually experienced, averaged over any calendar quarter, indicate that annual rates of release are likely to exceed a range of 4–8 times the design objective quantities and concentrations. Release rates within this range would be expected to keep the annual exposure rate to individuals offsite within a range of 20–40 mrems per year during the quarterly period. In the proposed guidance on technical specifications, provision would be made for an appropriate period of time for all licensees of light-water-cooled nuclear power reactors to implement the guidance with respect to facility operation.

Pursuant to the Atomic Energy Act of 1954, as amended, and section 553 of title 5 of the United States Code, notice is hereby given that adoption of the following amendment to 10 CFR Part 50 is contemplated. All interested persons who wish to submit comments or suggestions in connection with the proposed amendment should send them to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Chief, Public Proceedings Branch, within 60 days after publication of this notice in the FEDERAL REGISTER. Comments and suggestions received after that period will be considered if it is practicable to do so, but assurance of consideration cannot be given except as to comments filed within the period specified. Copies of comments received may be examined in the Commission's Public Document Room at 1717 H Street NW., Washington, D.C.

1. Section 50.34a of 10 CFR Part 50 is amended by adding the following sentence at the end of paragraph (a):

§ 50.34a Design objectives for equipment to control releases of radioactive material in effluents—nuclear power reactors.

(a) • • • The guides set out in Appendix I provide numerical guidance on design objectives for light-water-cooled nuclear power reactors to meet the requirement that radioactive material in effluents released to unrestricted areas be kept "as low as practicable."

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2. Section 50.36a of 10 CFR Part 50 is amended by adding the following sentence at the end of paragraph (b):

§ 50.36a Technical specifications on effluents from nuclear power reactors.

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(b) • • • The guides set out in Appendix I provide numerical guidance on limiting conditions for operation for light-water-cooled nuclear power reactors to meet the requirement that radioactive materials in effluents released to unrestricted areas be kept "as low as practicable."

3. A new Appendix I is added to read as follows:

APPENDIX I—NUMERICAL GUIDES FOR DESIGN OBJECTIVES AND LIMITING CONDITIONS FOR OPERATION TO MEET THE CRITERION "AS LOW AS PRACTICABLE" FOR RADIOACTIVE MATERIAL IN LIGHT-WATER-COOLED NUCLEAR POWER REACTOR EFFLUENTS

SECTION I. *Introduction.* Section 50.34a(a) provides that an application for a permit to construct a nuclear power reactor shall include a description of the preliminary design of equipment to be installed to maintain control over radioactive materials in gaseous and liquid effluents produced during normal reactor operations, including expected operational occurrences. In the case of an application filed on or after January 2, 1971, the application must also identify the design objectives, and the means to be employed, for keeping levels of radioactive material in effluents to unrestricted areas "as low as practicable".

Section 50.36a contains provisions designed to assure that releases of radioactivity from nuclear power reactors to unrestricted areas during normal reactor operations, including expected operational occurrences, are kept "as low as practicable".

This appendix provides numerical guidance on design objectives and limiting conditions for operation to assist applicants for, and holders of, licenses for light-water-cooled nuclear power reactors in meeting the requirement that radioactive material in effluents released from those facilities to unrestricted areas be kept "as low as practicable". This guidance is appropriate only for light-water-cooled nuclear power reactors and not for other types of nuclear facilities.

[1] A useful measure of the total exposure of a large number of persons is the man-rem. The exposure of any group of persons measured in man-rems is the product of the number of persons in the group times the average exposure in rems of the members of the group. Thus, if each member of a population group of ½ million people were exposed to 0.001 rem (1 millirem), the total man-rem exposure would be 1,000 man-rem.

SEC. II. *Guides on design objectives for light-water-cooled nuclear power reactors licensed under 10 CFR Part 50.* The guides for design objectives (expressed as quantities and concentrations of radioactive material in effluents) for light-water-cooled nuclear power reactors specified in paragraphs A and B of this section are sufficiently conservative to provide reasonable assurance that, for most locations having environmental characteristics likely to be considered acceptable by the Commission for a nuclear power reactor site, resultant increases in radiation exposures to individual members of the public living at the site boundary, due to operation of light-water-cooled nuclear power reactors at the site, will generally be less than 5 percent of exposures due to natural background radiation and average exposures to sizeable population groups will generally be less than 1 percent of exposures due to natural background radiation. The guides on design objectives for light-water-cooled nuclear power reactors set forth in paragraphs A and B of this section may be used by an applicant for a permit to construct a light-water-cooled nuclear power reactor as guidance in meeting the requirements of § 50.34a(a) that applications filed after January 2, 1971, identify the design objectives, and the means to be employed, for keeping levels of radioactive material in effluents to unrestricted areas as low as practicable.

A. For radioactive material above background in liquid effluents to be released to unrestricted areas by each light-water-cooled nuclear power reactor at a site:

1. The estimated annual total quantity of radioactive material, except tritium, should not exceed 5 curies; and

2. The estimated annual average concentration of radioactive material prior to dilution in a natural body of water, except tritium, should not exceed 0.00002 microcurie (20 picocuries) per liter; and

3. The estimated annual average concentration of tritium prior to dilution in a natural body of water should not exceed 0.005 microcurie (5,000 picocuries) per liter.

B. For radioactive material above background in gaseous effluents, the estimated total quantities of radioactive material to be released to unrestricted areas by all light-water-cooled nuclear power reactors at a site should not result in:

1. An annual average exposure rate due to noble gases at any location on the boundary of the site or in the offsite environment in excess of 10 millirems;[3] and

• • • • •

2. Annual average concentrations at any location on the boundary of the site or in the offsite environment of radioactive iodines, or radioactive material in particulate form with a half-life greater than 8 days, in excess of the concentrations in air specified in Appendix B, Table II, Column I, of 10 CFR Part 20, divided by 100,000.

C. Notwithstanding the guidance in paragraphs A and B above, design objectives, based on quantities and concentrations of radioactive material above background in effluents to be released to unrestricted areas, higher than those specified in those paragraphs may be deemed to meet the requirement for keeping levels of radioactive material in effluents to unrestricted areas as low as practicable if the applicant provides reasonable assurance that:

1. For radioactive material above background in liquid effluents to be released to unrestricted areas by all light-water-cooled nuclear power reactors at a site, the proposed higher quantities or concentrations will not result in annual exposures to the whole body or any organ of an individual in excess of 5 millirems; [4] and

2. For radioactive noble gases and iodines and radioactive material in particulate form above background in gaseous effluents to be released to unrestricted areas by all light-water-cooled nuclear power reactors at a site, the proposed higher quantities and concentrations will not result in annual exposures to the whole body or any organ of an individual in excess of 5 millirems.

D. Notwithstanding the guidance in paragraphs A, B, and C above, for a particular site the Commission may specify, as guidance on design objectives, lower quantities and concentrations of radioactive material above background in effluents to be released to unrestricted areas if it appears that the use of the design objectives described in those paragraphs is likely to result in releases of total quantities of radioactive material from all light-water-cooled nuclear power reactors at the site that are estimated to cause an annual exposure in excess of 5 millirems to the whole body or any organ of an individual in the offsite environment from radioactive material above background in either liquid or gaseous effluents.

SEC. III. *Guides on technical specifications for limiting conditions for operation for light-water-cooled nuclear power reactors licensed under 10 CFR Part 50.* The guides on limiting conditions for operation for light-water-cooled nuclear power reactors set forth below may be used by an applicant for a license to operate a light-water-cooled nuclear power reactor as guidance in developing technical specifications under § 50.36a(a) to keep levels of radioactive materials in effluents to unrestricted areas as low as practicable.

Section 50.36a(b) provides that licensees shall be guided by certain considerations in establishing and implementing operating procedures that take into account the need for operating flexibility while at the same time assure that the licensee will exert his best effort to keep levels of radioactive material in effluents as low as practicable. The guidance set forth below provides more specific guidance to licensees in this respect.

In using the guides set forth in section IV it is expected that it should generally be feasible to keep average annual releases of radioactive material in effluents from light-water-cooled nuclear power reactors within the levels set forth as numerical guides for design objectives in section II above. At the same time, the licensee is permitted the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power even under unusual operating conditions which may temporarily result in releases higher than such numerical guides for design objectives, but still within levels that assure that actual exposures to the public are small fractions of natural background radiation. It is expected that in using this operational flexibility under unusual operating conditions, the licensee will exert his best efforts to keep levels of radioactive material in effluents within the numerical guides for design objectives.

SEC. IV. *Guides for limiting conditions for operation for light-water-cooled nuclear power reactors.* A. If rates of release of radioactive materials in effluents from light-water-cooled nuclear power reactors actually experienced, averaged over any calendar quarter, are such that the estimated annual quantities or concentrations of radioactive material in effluents are likely to exceed twice the design objective quantities and concentrations set forth in section II above, the licensee should:

1. make an investigation to identify the causes for such release rates; and

2. define and initiate a program of action to reduce such release rates to the design levels; and

3. report these actions to the Commission on a timely basis.

B. If rates of release of radioactive material in liquid or gaseous effluents actually experienced, averaged over any calendar quarter, are such that estimated annual quantities or concentrations of radioactive material in effluents are likely to exceed a range of 4–8 times the design objective quantities and concentrations set forth in section II above,[5] the Commission will take appropriate action to assure that such release rates are reduced. (Section 50.36a(a) (2) requires the licensee to submit certain reports to the Commission with regard to the quantities of the principal radionuclides released to unrestricted areas. It also provides that, on the basis of such reports and any additional information the Commission may obtain from the licensee and others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.)

C. The guides for limiting conditions for operation described in paragraphs A and B of this section are applicable to technical

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[3] An exposure rate such that a hypothetical individual continuously present in the open at any location on the boundary of the site or in the offsite environment would not incur an annual exposure in excess of 5 millirems. This neglects the reduction in the exposures to a real individual that would be afforded by the distance from the site boundary at which the individual is located, shielding provided by living indoors and periods of time the individual is not present in the area.

[4] For purposes of the guides in Appendix I, exposure of members of the public should be estimated from distributions in the environment of radioactive material released in effluents. For estimates of external exposure the rem may be considered equivalent to the rad; and account should be taken of the appropriate physical parameters (energy of radiation, absorption coefficients, etc.). Estimates of internal dose commitment, in terms of the common unit of dose equivalence (rem), should be generally consistent with the conventions or assumptions for calculational purposes most recently published by the International Commission on Radiological Protection which apply directly to intakes of radioactive material from air and water, and those applicable to water may be applied to intakes from food. These conventions or assumptions should be used for calculations of dose equivalence except for exposures due to strontium-89, strontium-90, or radionuclides of iodine. For those radionuclides the biological and physical assumptions of FRC Report No. 2 should be used. It is assumed that annual average concentrations of radioactive iodine in the environment, as listed in Part 20, Appendix B, Table II, would result in annual doses of 1.5 rems to the thyroid and the concentration of strontium-89 or strontium-90 would result in annual doses of 0.5 rem to the bone. Exposure to the whole body should be assessed as exposure to the gonads or red bone marrow.

[5] Release rates within this range would be expected to keep the annual exposure rate to individuals offsite within a range of 20–40 mrems per year during this quarterly period.

specifications included in any license authorizing operation of a light-water-cooled nuclear power reactor constructed pursuant to a construction permit for which application was filed on or after January 2, 1971. For light-water-cooled nuclear power reactors constructed pursuant to a construction permit for which application was filed prior to January 2, 1971, appropriate technical specifications should be developed to carry out the purposes of keeping levels of radioactive material in effluents to unrestricted areas as low as practicable. In any event, all holders of licenses authorizing operation of a light-water-cooled nuclear power reactor should, after (36 months from effective date of this guide), develop technical specifications in conformity with the guides of this Section.

(Sec. 161, 68 Stat. 948; 42 U.S.C. 2201)

Dated at Washington, D.C., this 4th day of June 1971.

For the Atomic Energy Commission.

W. B. McCool,
Secretary of the Commission.

[FR Doc.71-8049 Filed 6-8-71;8:51 am]