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TERRESTRIAL ENVIRONMENTAL STUDIES FOR NUCLEAR POWER STATIONS

A. INTRODUCTION

This guide provides technical guidance that U.S. Nuclear Regulatory Commission (NRC) staff considers acceptable for terrestrial environmental studies and analyses supporting licensing decisions for nuclear power reactors. The NRC issued Regulatory Guide (RG) 4.11, Revision 1, in August 1977 before the implementation of many environmental regulations affecting licensing decisions. For purposes of this guide, the term "terrestrial" encompasses permanently dry lands (uplands) and those wetlands and other aquatic features supporting emergent (not submerged) vegetation. The NRC generally includes wetland and riparian (riverside) habitats with terrestrial issues as a matter of convenience, even though these habitats interface with aquatic habitats. This guide does not address aquatic areas containing only submerged aquatic vegetation. For purposes of this guide, the term "terrestrial environmental study" refers to ecological studies and assessments focused on characterizing environmental impacts on flora and fauna and their habitats. Most terrestrial environmental studies performed in connection with NRC licensing decisions support decisionmaking under the National Environmental Policy Act (NEPA). This guidance is intended to improve the consideration of terrestrial environmental impacts in environmental impact statements and other documents produced to comply with NEPA.

This guide defines general objectives for terrestrial analyses but does not provide stepwise instructions or technical protocols. Professional judgment is necessary when identifying analytical methods appropriate to each licensing decision and when collecting the associated data. Various agencies and other parties are continually refining terrestrial ecology protocols and developing new approaches to achieve regulatory objectives. Applicants using this guide should contact appropriate Federal and State

environmental regulatory agencies and search recent scientific literature for specific data collection protocols and analytical processes. Applicants should justify the methods selected.

This guide focuses on terrestrial analyses for licensing new nuclear power stations under the combined licensing process in Title 10, of the *Code of Federal Regulations*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (10 CFR Part 52) (Ref. 1) and power reactors under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 2). This guide is also useful in identifying the more limited studies and analyses needed for nuclear reactor operating license renewal under 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (Ref. 3), and portions may also be relevant to nuclear reactor decommissioning.

Terrestrial analyses are also addressed in guidance documents that the NRC has developed to help applicants prepare multidisciplinary environmental information for license applications. These documents include RG 4.2, "Preparation of Environmental Reports for Nuclear Power Stations" (Ref. 4), and RG 4.7, "General Site Suitability Criteria for Nuclear Power Stations" (Ref. 5). This guide provides focused guidance on terrestrial environmental studies and analyses supporting the broader environmental objectives in these other RGs. Like other NRC RGs, this guide addresses information that the NRC uses in making regulatory decisions. It does not necessarily cover all of the terrestrial environmental information that other Federal, State, or local regulatory agencies may need.

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required.

This regulatory guide contains information collection requirements covered by 10 CFR Part 51 (Ref. 6) that the Office of Management and Budget (OMB) approved under OMB control number 3150-0021. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number. This regulatory guide is a rule as designated in the Congressional Review Act (5 U.S.C. 801–808). However, the NRC has determined this regulatory guide is not a major rule as designated by the Congressional Review Act and has verified this determination with the OMB.

The NRC has an interest in facilitating the harmonization of standards used internationally. In this case, we did not find similar elements between this regulatory guide and the IAEA safety guides.

B. DISCUSSION

Background

Terrestrial analyses can be broadly classified as those providing siting support, baseline investigations, identification of important species and habitats, impact analyses, monitoring efforts, and decommissioning support. The applicant should use best professional judgment to develop and justify the objectives of terrestrial studies, their spatial and temporal coverage, their level of detail, and methods of data collection.

Terrestrial Siting Support

Terrestrial ecology is one of several technical disciplines involved in the site selection (screening) process commonly used to license a new nuclear power plant under 10 CFR Part 50 or 10 CFR Part 52. The discussion of site selection procedures in this guide is limited to terrestrial ecological issues. The presence or absence of terrestrial ecological resources contributes to screening a region of interest to identify sites for further evaluation. Information on the site selection process commonly used for nuclear power plants appears in Electric Power Research Institute Report No. 1006878, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," issued 2002 (Ref. 7); RG 4.2; and RG 4.7. Terrestrial ecology is also a factor in evaluating alternative energy sources and alternative heat dissipation systems. The siting guidance below is expected to be useful only to licensing new reactors; siting is generally not a consideration in license renewal.

Site Selection (Site Alternatives)

Reconnaissance-level information and published data are the primary information sources used to identify terrestrial ecology resources for site selection purposes. Each step in the site selection process increases the level of detail used in identifying sensitive resources (including but not limited to terrestrial ecological resources), further narrows the field of possible sites, and increases confidence in the extent to which the resulting field of sites avoids sensitive resources. The region of interest may be initially screened at a coarse scale (e.g., using maps or aerial photographs at a scale of 1:250,000) to identify candidate areas that best exclude large land areas dedicated to ecological management (e.g., national wildlife refuges, critical habitat for Federally listed threatened or endangered species, and State wildlife or natural areas) and larger wetlands or floodplains. Areas passing the initial screen may then be screened more closely by overlaying a polygon approximating the size of a project site on a resource map with a finer scale showing protected species and smaller wetland and floodplain areas that had been indiscernible at the coarser scale. The polygon may be repositioned multiple times over the map as needed to identify a suite of candidate sites for further investigation.

Candidate sites can then be compared using specific qualitative and quantitative criteria. Criteria may include numbers of known occurrences of Federally or State-listed species; the amount and quality of upland and wetland habitats; distance from wetlands, shorelines, and riparian zones; and other pertinent ecological attributes. Criteria may be scored and potential sites compared using the scores. Scoring criteria should reflect information that is as uniform in detail and accuracy as possible among candidate sites. Scores should be reviewed for possible bias derived from the differing quality of available data. For example, the number of known occurrences of Federally or State-listed species may vary from site to site depending on how well the differing geographic regions have been characterized in the past. Applicants should justify the criteria selected and the criteria scoring schemes.

The applicant may identify a final suite of alternative sites, including a proposed site and alternative sites, by comparing candidate sites based on potential impacts to the terrestrial ecology resources noted above. The analysis normally entails further screening at a higher confidence level using more detailed, site-specific data developed from onsite verification surveys; the analysis should also consider potential impacts from transmission lines and other offsite development (e.g., pipelines or access roads). Site preparation and other project development impacts (e.g., presence of high-quality habitats and proximity to protected species) and operation impacts (e.g., distance to wetlands potentially affected by surface water drawdown or groundwater depletion) can be scored subjectively and then compared.

The evaluation of alternative sites needed by NRC staff may partially overlap that required by the U.S. Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act (CWA) (Ref. 8). Applicants may find it efficient to evaluate terrestrial ecology resources at alternative sites following an integrated approach that simultaneously achieves what is needed by both NRC and the Corps. Applications for Section 404 permits must demonstrate that the proposed site is the least environmentally

damaging practicable alternative (LEDPA) under the alternatives analysis guidelines in 40 CFR Part 230, "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material" (Ref. 9), developed by the U.S. Environmental Protection Agency (EPA). Practicable alternatives include, but are not limited to, discharges of dredged or fill material at other locations (see Subpart B, "Compliance with the Guidelines," of 40 CFR Part 230). Applicants may contact the regional Corps district office to acquire information on local application of the LEDPA guidelines in 40 CFR Part 230 for site selection.

Energy Alternatives

Terrestrial ecology is one of several technical disciplines involved in evaluating whether alternative energy sources requiring new generating capacity are competitive with the proposed energy source. RG 4.2 identifies alternative energy sources for new generating capacity. Nuclear, coal, natural gas, and a combination of alternatives are the most commonly considered alternative energy sources for new baseload power generating capacity; these alternative energy sources are normally compared under the assumption that they would be developed on the proposed site. There are no specific terrestrial ecology criteria to evaluate competitiveness between the alternative energy sources and the proposed source. Instead, terrestrial resources potentially affected by each energy alternative typically are described and compared at a coarse (low) level of resolution (e.g., use of previously disturbed versus undisturbed habitat) and are not quantified.

As indicated for site alternatives, the evaluation of alternative energy sources needed by NRC staff may partially overlap that needed by the Corps to demonstrate that a nuclear energy source is the LEDPA under the EPA alternatives analysis guidelines in 40 CFR Part 230. Practicable alternatives include functional alternatives (see Appendix B, "NEPA Implementation Procedures for the Regulatory Program," to 33 CFR Part 325, "Processing of Department of the Army Permits" (Ref. 10)) such as energy alternatives. Applicants may contact the regional Corps district office to acquire information on local application of the LEDPA guidelines for energy source evaluation. The Corps may require terrestrial environmental data beyond those recommended for NRC purposes in this guide.

Heat Dissipation System Design Alternatives

Terrestrial ecology is also a factor for assessing design alternatives for heat dissipation systems for nuclear power plants. Depending on the particular site, possible alternative heat dissipation systems may include once-through systems and closed-cycle systems such as mechanical draft wet cooling towers, natural draft cooling towers, wet-dry cooling towers, dry cooling towers, cooling ponds, and spray ponds. No specific terrestrial ecology criteria are normally used to compare the alternative heat dissipation systems. Instead, terrestrial resources potentially affected by each alternative are typically described and compared at a coarse (low) level of resolution (e.g., identifying general habitat types, such as forests or wetland, that system development would impact and the general operational effects of different cooling tower systems, such as salt drift and avian collisions) and are not typically quantified.

Sources of Information

The following information sources are useful for identifying terrestrial ecological resources for purposes of project siting:

a. online mapping products, including but not limited to topographic maps from the U.S. Geological Survey (USGS);
b. National Wetland Inventory (NWI) maps from the U.S. Fish and Wildlife Service (FWS);
c. State wetland maps such as those developed by Maryland and New Jersey;

d. State (e.g., Natural Heritage Program) and Federal (e.g., FWS) data on the potential occurrence of threatened, endangered, and other protected species and habitats;
e. county soil surveys from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service);
f. flood insurance rate maps from the Federal Emergency Management Agency;
g. Federal, State, and private land use and land cover maps, including the following:

- the USDA National Agricultural Imagery Program (Ref. 11),
- multiple-resolution land characteristics consortium national land cover database (Ref. 12),
- others described in the section below regarding terrestrial habitat identification, and
- existing and projected future land use maps from local planning and zoning offices.

State and regional wetland maps are generally more reliable than NWI maps. However, some maps only show tidal (coastal) wetlands or wetlands that meet size or quality thresholds. Therefore, applicants may have to use State or regional maps in conjunction with NWI maps (or other broadly scoped maps) to provide information on all wetland types. County soil surveys show soils indicative of wetlands (hydric soils) and other potentially sensitive habitats such as sand dunes. Floodplains depicted on flood insurance rate maps may contain sensitive riparian or coastal habitats. If land use or land cover maps are not available, aerial photographs or satellite imagery can provide similar data.

Terrestrial Environmental Baseline Investigations

Terrestrial environmental baseline investigations inventory and characterize upland and wetland flora, fauna, and habitats in potentially affected areas on, and in the vicinity of, a proposed site, including the associated offsite rights-of-way for features such as transmission lines. Baseline investigations form a basis for assessing potential impacts to terrestrial resources and serve as a foundation for related Federal and State monitoring and mitigation requirements. The detail should be roughly proportional to the anticipated magnitude of potential impacts and the level of information needed to evaluate the significance of the impacts. The spatial extent of potential impacts can extend beyond the proposed limits of ground disturbance to encompass areas potentially affected by other activities, such as surface water or groundwater drawdown, spoils disposal, noise, runoff, dust deposition, and cooling tower drift. Studies of terrestrial resources within the area of development and operation should generally be more detailed than studies of peripheral areas. The spatial extent and detail of baseline investigations may have to be expanded to address the concerns of interested Federal, State, Tribal, local, and private organizations.

The detail needed for baseline investigations may be less for proposed sites that have been partially developed (e.g., sites within an existing nuclear power plant property or a property with other energy production facilities) and that have been the subject of recent past ecological investigations. The applicant may use descriptive field information gathered during previous environmental reviews to contribute to the description of the current condition of terrestrial resources, as long as the information is updated and augmented as necessary with current field investigation data. The updated data collection should address habitats lost and created by development of existing facilities (e.g., early successional upland habitats created by prior establishment of borrow and laydown areas, shoreline habitats that develop after the creation of cooling reservoirs) and ongoing natural processes that have taken place since collection of the earlier data.

In general, the detail needed for license renewal is expected to be less than what is needed for new reactors. Not only does license renewal typically involve less extensive modifications to the terrestrial environment, the ecological conditions on renewal sites are more likely to have been previously characterized.

Because baseline investigations form the foundation for subsequent analyses and monitoring, applicants should initiate them as early as possible and ensure that they are broad enough to support anticipated subsequent studies. Applicants performing terrestrial baseline investigations should seek input from interested Federal, State, Tribal, local, and private organizations when initially designing the investigations. Some baseline investigations commonly useful for NRC-licensed activities include the following:

a. terrestrial habitat identification,
b. terrestrial habitat mapping,
c. terrestrial habitat description,
d. flora studies,
e. fauna studies,
f. wetland delineations,
g. wetland functional assessments, and
h. identification of important species and habitats.

Applicants can prepare terrestrial baseline studies as stand-alone reports or present them initially within an environmental report (see RG 4.2) or other broadly scoped environmental document. Applicants can combine closely related baseline studies into single reports (e.g., presenting terrestrial habitat identification, mapping, and description logically in a single report) and prepare flora and fauna survey reports separately, together, or combined with a terrestrial habitat survey report and map. Wetland delineations and functional assessments are commonly prepared as stand-alone reports.

Applicants may be able to draw upon existing scientific literature to obtain some of the necessary baseline data. Terrestrial ecological baseline studies may have already been prepared to support other projects on or near the site. Websites, databases, or other information sources maintained by Federal, state, or local agencies or conservation organizations may also contain useful data. Applicants would have to use professional judgment to evaluate the applicability or possible obsolescence of the data.

Terrestrial Habitat Identification

Terrestrial habitats should be identified on the proposed site and adjoining property, as well as along any new or existing transmission line corridors affected by the proposed action. The area of potential effects can extend beyond the proposed limits of ground disturbance to encompass habitats potentially affected by surface water drawdown or groundwater depletion, spoils disposal noise, runoff, dust deposition, cooling tower drift, and other activities.

Although environmental documents have traditionally designated terrestrial habitats using broad vegetation-based terms such as “forest,” “scrub,” “thicket,” “field,” “open land,” “marsh,” and “swamp,” nomenclature systems with more precisely defined terms are available as discussed below. Applicants should inquire with Federal and State regulatory agencies whether they recommend use of a specific identification system. Newer systems and updated versions of current systems may be developed or updated over time.

The USGS attempted to standardize the nomenclature for land cover, and hence terrestrial habitat, in the 1970s (Ref. 13). Its system comprises a broad “Level I” series of land cover classes resolvable from satellite imagery, followed by tiered Level II, III, and IV classes resolvable from progressively more detailed aerial photography. The Nature Conservancy (TNC) later developed the U.S. National Vegetation Classification (USNVC) system (Ref. 14). The highest tier “class” distinguishes broad features such as forest and shrubland. The next tier “subclass” distinguishes gross vegetation differences such as deciduous versus evergreen forest. Lower tiers provide increasing specificity. The lowest (most

detailed but least commonly used) levels of the USNVC system, the alliance and association, rely on indicator species. Indicator species characterize a habitat because they are dominant or otherwise distinguish the vegetation. Separate from the USNVC system, the U.S. Forest Service has developed standardized designations for forest cover using indicator species (Ref. 15). However, the U.S. Forest Service system is useful only in describing forested habitats.

Perhaps the most broadly available uniform source for terrestrial land cover data geared specifically to ecological management is the national landcover map produced as part of the Gap Analysis Program (GAP) administered by the USGS (Ref. 16). The GAP strives to identify wildlife species and plant communities that are not adequately protected by conservation programs. As with the earlier USGS approach to land cover, the GAP national landcover map provides three levels of detail. As of 2010, Level 1 contained eight classes based on generalized vegetation physiognomy (e.g., grassland, shrubland, and forest). Level 2 contained 43 classes distinguishing broad vegetation differences, such as deciduous versus evergreen forest. Level 3 contained 590 classes.

Some States have also developed terrestrial habit/resource classification systems. For example, Florida developed a tailored version of the USGS system called the Florida Land Use, Cover, and Forms Classification System (Ref. 17). Other States, such as Maryland, have tailored the USNVC system to regional conditions (Ref. 18).

The degree of habitat resolution within the geographic area of interest will vary among the different land cover and land use systems. Thus, applicants should select the tool or combination of tools that provides habitat resolution adequate to identify habitat impacts and to quantify impacts where necessary. The applicant should contact the regional Corps district office to ascertain recommended tools for identifying and quantifying impacts to wetlands.

Terrestrial Habitat Mapping

Habitats can be mapped using USGS Level I and II classes, USNVC system classes and subclasses, or equivalents using only aerial photography or aerial photography with limited site reconnaissance. More detailed field observation is usually needed to use USGS Level III or IV classes, USNVC system floristic alliances or associations, or indicator species. Map detail should generally be greater for the proposed footprint of ground disturbance than for peripheral areas. The applicant should adjust the level of detail to meet the anticipated complexity of impact assessment and to address the concerns of various interested agencies and organizations. Table 1 provides an example of how terrestrial habitats might be mapped for a new reactor licensing project under 10 CFR Part 52.

Table 1. Example Approach to Habitat Mapping for a New Reactor Project

AREA OF COVERAGE	EXAMPLE LEVEL OF DETAIL FOR TERRESTRIAL HABITAT MAPPING
Areas subject to land clearing or grading on, or in the vicinity of, the proposed site plus a reasonable buffer tailored to site conditions	GAP Level 3, USNVCS alliance, or equivalent or use of indicator species; based on satellite imagery, aerial photographs, and detailed field investigation
Areas subject to land clearing or grading on a transmission line right-of-way (or other offsite rights-of-way) plus a reasonable buffer	GAP Level 3, USNVCS alliance, or equivalent or use of indicator species; based on satellite imagery, aerial photographs, and detailed field investigation
Areas not subject to land clearing	GAP Level 2, USNVCS subclass, or equivalent; based on satellite

or grading or within the associated buffer but subject to other types of impacts such as noise or atmospheric deposition	imagery, aerial photographs, and reconnaissance-level field investigation
Areas not subject to impact but for which information is needed to understand the spatial context of impacted areas	GAP Level 2, USNVCS subclass, or equivalent; based on satellite imagery, aerial photographs, and reconnaissance-level field investigation

Boundaries between adjoining terrestrial habitats can usually be traced from vertical aerial photographs or satellite imagery. Aerial photography flown during leaf-off seasons (usually winter) is superior because it differentiates deciduous from evergreen forest, woodland, and shrubland subclasses. Leaf-off color infrared aerial photography can be used to differentiate fine twig and foliar differences between tree species (e.g., to distinguish bald cypress (*Taxodium distichum*) from pines (*Pinus* spp.)). Table 2 presents suggested ideal and minimal conditions for imagery used to delineate terrestrial habitats. The ability to acquire better remote sensing imagery at reasonable cost and effort will likely continue to improve with technological advances. Remote-sensing imagery should always be representative of current habitat conditions and thus should be confirmed by data as necessary.

Table 2. Suggested Remote Sensing Imagery Characteristics for Habitat Mapping

PARAMETER	RECOMMENDED IF POSSIBLE	RECOMMENDED IF BETTER IMAGERY NOT AVAILABLE
Age	Previous 5 years	Previous 20 years but interpret with extreme care
Scale	1:6,000 or better	1:24,000
Orientation	Vertical, georeferenced	Vertical, georeferenced
Color	Leaf off, color infrared	Leaf off, color or black and white

Habitat maps should be scaled and created from georeferenced geographic information system layers. Maps should include a title, date, revision number, north arrow, graphic scale bar, and legend identifying each habitat type and other mapping features. Maps should show features such as existing topography, roads, streams, and buildings as necessary to provide general spatial orientation.

Terrestrial Habitat Description

Most terrestrial habitats are best described by vegetative strata, which are groupings of plants at the same general height. Various definitions are available for vegetative strata. The following set was originally developed for wetland delineation (Refs. 19 and 20), but it can used to describe most natural vegetation:

- Tree canopy includes woody plants over 20 feet (6.1 meters) tall and 5 inches (0.13 meter) in diameter at breast height.
- Subcanopy (sapling stratum) includes woody plants over 20 feet tall (6.1 meters) and under 5 inches (0.13 meter) in diameter at breast height.
- Shrub stratum includes woody plants over 3 feet (1 meter) and under 20 feet (6.1 meters) tall.
- Groundcover includes woody and nonwoody plants (i.e., forbs, grasses, grasslike plants, ferns, and bryophytes) under 3 feet (1 meter) tall.
- Woody vine stratum includes woody vines supported by trees, saplings, and shrubs.

Descriptions should identify dominant (the most prevalent) plant species in each stratum. Commonly used dominance metrics include percent cover (for any stratum), basal area (for trees), stem

count (for subcanopy, shrub, or woody vine strata), or fresh or dry weight (for groundcover) (Ref. 21). Traditional application of these metrics entails the use of quantitative field methods, which are the most accurate means of distinguishing dominant species. However, experienced biologists might be able to identify the dominant species more readily through visual estimation. For example, a tree species might be visually estimated to have the greatest canopy cover or basal area without actual collection of such measurements. In most instances, visual estimation of dominant species within vegetation strata is sufficient for the purpose of habitat description.

Descriptive detail should generally be greater for the footprint of potential impacts on, and in the vicinity of, the proposed site and along affected new or existing transmission lines than for the surrounding areas. Other descriptive information may be useful when describing terrestrial habitats, including the following:

- Presence of invasive species. Executive Order 13112, "Invasive Species," dated February 3, 1999 (Ref. 22), defines invasive plant species as alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. Invasive plant species include, but are not limited to, species on Federal or State noxious weed lists. Information may be available from the USDA cooperative extension service local or regional offices and relevant departments of the State's associated land-grant university.

- Disease vectors, pests, or nuisance species. Examples include chestnut blight fungus (*Cryphonectria parasitica*), Dutch elm disease fungus (*Ophiostoma ulmi*) carried by the American elm bark beetle (*Hylurgopinus rufipes*), and emerald ash borer (*Agrilus planipennis*).

- Landscape biogeography information. A habitat description should indicate whether the habitat serves as a wildlife travel corridor. Examples include forested stream valleys traversing agricultural landscapes and linear threads of naturally vegetated land traversing urban landscapes. Similarly, the habitat might serve as an "oasis" or "stepping stone" facilitating wildlife movement across a landscape. Examples include forested woodlots in agricultural settings and parklands in urban settings.

- Existing natural and human-induced effects. Past or ongoing natural and human processes have altered most terrestrial habitats. Examples of natural processes include wildfires, flooding, and wildlife grazing. Examples of human-induced processes include agriculture and timber management, livestock grazing, and the dumping of solid waste.

- Recent or ongoing ecological or biological studies or management. The description for a terrestrial habitat should note whether the habitat is the site of ecological investigations or management actions. If so, impacts to the habitat could simultaneously affect the studies or programs.

Flora and Fauna Surveys

Tabular lists of observed plant and wildlife species greatly enhance habitat descriptions. The majority of plant and wildlife species in the area of potential impacts should be identified. Therefore, field surveys are best conducted when flora and fauna are most readily detected and identified. For example, in temperate regions of the United States, plants generally flower in the spring, summer, or fall; therefore, flora surveys are best conducted in each of these seasons. Birds may be resident or migratory or both at various times during the year, so fauna surveys addressing birds are best conducted in each of the four seasons. Amphibians and reptiles are generally active from spring through fall; however,

amphibians are most detectable by their calls in spring during the reproductive period. Thus, amphibian and reptile surveys are best conducted in the spring, and supplementary surveys may be conducted as necessary in the summer or the fall. Mammals are generally active from spring through fall, so surveys addressing mammals should be conducted during one or more of these seasons. Investigations for subtropical sites may be enhanced by supplemental winter surveys for plants and wildlife.

Applicants should be generally familiar with the species that could potentially occur in the areas where they will conduct flora and fauna surveys. Thus, applicants should review any existing botanical and wildlife data for the survey area or nearby areas with similar habitats. Applicants should contact Federal, State, Tribal, local, and private organizations to acquire such data. These data may identify wildlife and plant species that could potentially inhabit the subject areas and may help the applicant identify suitable survey methods. The agencies may also direct the applicant to survey for specific listed species and other species of regional interest and may provide recommended survey timings and protocols specific to such species. For certain species, the agencies may request that uniquely qualified specialists conduct the surveys. Examples of potentially useful sources of information include the following:

a. conservation plans that FWS or State wildlife agencies may have prepared for privately owned tracts;
b. detailed botanical and wildlife inventories that TNC may have conducted on public and private lands;
c. conservation plans NRCS may have prepared for agricultural properties;
d. surveys conducted at nearby public facilities such as parks, national or State forests or wildlife refuges, and institutional properties containing similar habitat types as the area to be surveyed;
e. regional biological surveys, such as the Christmas Bird Count and Breeding Bird Survey, and State game data; and
f. field guides with range maps indicating species that could potentially occur in a geographic area.

Existing botanical and wildlife inventory data collected from the survey area may serve as a partial substitute for new field surveys in areas where the habitat has not changed substantially. Existing survey data that reflect current conditions should be updated and augmented through limited field surveys (i.e., a lesser level of effort than that for surveys of areas with no existing botanical and wildlife data) and may be used to plan such limited surveys. When using existing data, the applicant should consider the spatial extent, purpose, and techniques of the original data collection. Consideration of these factors may identify certain locations and groups of plants and animals that were omitted during the original data collection effort and that should be surveyed. Existing site-specific botanical and wildlife data that no longer reflect current conditions (e.g., a habitat has substantially changed) and areas without existing data will require reconnaissance surveys for planning purposes, followed by detailed field surveys (i.e., a greater level of effort than that for surveys of areas with applicable existing botanical and wildlife data).

Flora surveys should include well-defined survey routes in all potentially affected plant communities and habitats. Survey routes should be spaced so that plant communities and their vegetation strata are thoroughly (although not necessarily exhaustively) covered, including any substantial microenvironments. The spacing of survey routes will depend on the density of vegetation and topography because these factors affect visibility. Botanical surveys should list, but do not need to enumerate, individuals of common species; however, they should include numbers or estimates of numbers, where feasible, of rare species. Applicants should list each observed species in a table. For each species, the table (at a minimum) should provide the scientific name, common name, habitat(s) and vegetative strata where observed, and observation date. The table should also include a verbal description of abundance. The text should explain the data collection methods used. A graphic should show survey routes or transects overlaid on a map or sketch of the investigated habitats.

Fauna surveys should employ standard techniques suitable for the detection and identification of the category of wildlife (i.e., mammals, birds, amphibians, and reptiles) and any life stages of interest. Wildlife surveys should also note the presence of any insects or other invertebrates of interest. Survey methods should readily permit the detection and identification of species preferably by sight first, then by calls, and followed by other signs (e.g., tracks, scat and guano, nests, feathers, skulls, eggs, burrows, food caches, and scratches or drags on the soil surface) that permit positive identification of the species. Wildlife survey sample locations (e.g., stations, transects, and points) should be spaced such that most of the wildlife species are identified. Spring and fall surveys are best timed to coincide as closely as possible with peak bird migration or amphibian calling periods. Wildlife surveys are best conducted during the time of day that maximizes the detection and identification of species (e.g., early morning for breeding birds and dusk and nighttime for breeding amphibians and bats). Wildlife surveys should list, but do not need to enumerate, individuals of common species; however, they should include numbers or estimates of numbers, where feasible, of rare species. Applicants should list each observed species in a table. For each species, the table should (at a minimum) provide the scientific name, common name, habitat(s) where observed, date(s) observed, sex and age class, sign observed, and qualitative notes on abundance.

Other field observations useful in evaluating the suitability of terrestrial habitats for wildlife include the following:

a. wildlife food sources such as hard mast (nuts), soft mast (berries and other soft fruits), grain and small seeds, and foliage (browse);
b. standing dead trees (snags) with and without cavities;
c. downed dead trees, limbs, and other woody debris;
d. trees with exfoliating (flaking or peeling) bark (favored by certain bats and small birds);
e. the presence of trees near shorelines (favored by bald eagles and water birds); and
f. small ground depressions that can trap rainwater (favored by many amphibians).

Wetland Delineation

Wetlands are a special habitat category that provide unique hydrological and ecological functions and receive special regulatory protection. In 33 CFR Part 328, "Definition of Waters of the United States" (Ref. 23), the Corps defines wetlands as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

Section 404 of the CWA authorizes the Corps to issue permits for work in "waters of the United States," a term that includes many but not all wetlands. Michigan and New Jersey have been delegated partial responsibility for administering Section 404, although the Corps retains oversight. Some other States have implemented State wetland regulations that complement Section 404. Some States protect certain categories of wetlands, such as tidal wetlands (e.g., most coastal states) or wetlands exceeding specified size or quality thresholds (e.g., New York). The NRC does not directly regulate wetlands or issue permits for wetland impacts, but it does consider impacts to jurisdictional and nonjurisdictional wetlands when making licensing decisions.

Wetland delineation is the process of identifying and mapping wetlands. The Corps presently requires CWA Section 404 permit applicants to conduct onsite wetland delineations using the following guidance documents:

a. Technical Report Y-87-1, "Corps of Engineers Wetlands Delineation Manual," issued January 1987 (commonly referred to as the "1987 Manual") (Ref. 24);

b. "Clarification and Interpretation of the 1987 Manual," dated March 6, 1992, (Ref. 19); and
c. "Use of NRCS Field Indicators of Hydric Soils," dated March 21, 1997 (Ref. 25).

The Corps is also developing regional supplements to the 1987 Manual that provide guidance for individual physiographic regions. Wetland delineators should confer with the Corps and any State wetland regulatory agencies to determine which, if any, regional supplement or other updated guidance to the 1987 Manual should be followed. Wetland delineation reports should include a map showing delineated wetland boundaries and the locations of data points or transects used for collecting field data. The map should label wetlands using nomenclature such as that of FWS (Ref. 26). Wetland delineations should be completed as soon as practicable on sites proposed for new ground disturbance.

Wetland Functional Assessment

Multiple techniques, called "functional assessment methods," are available for use in assessing the ecological and hydrological roles that individual wetlands play. The NRC does not require or endorse the use of any specific procedure, but applications should include an analysis of the functions and values of wetlands affected by licensed activities.

Functional assessment methodologies can be descriptive or semiquantitative. The oldest Federal technique, called the Wetland Evaluation Technique (Ref. 27), uses the responses to a questionnaire to predict whether a wetland may provide specific functions and values. Functions are physical, chemical, or biological activities that directly benefit society or the environment. Values are indirect social benefits such as aesthetic qualities or availability for recreation. The New England District of the Corps developed a structured approach, called the Highway Methodology (Ref. 28), for a descriptive functional assessment. Descriptive methodologies provide good information when performed by an experienced professional. Specific values and functions considered by the Highway Methodology include the following:

a. groundwater recharge and discharge (function);
b. floodflow alteration (function);
c. fish and shellfish habitat (function);
d. sediment, toxicant, and pathogen retention (function);
e. nutrient removal, retention, and transformation (function);
f. production export (function);
g. sediment and shoreline stabilization (function);
h. wildlife habitat (function);
i. recreation (value);
j. education and scientific value (value);
k. uniqueness and heritage (value);
l. visual quality and aesthetics (value); and
m. threatened or endangered species habitat (value).

Several semiquantitative functional assessment methods involve the calculation of scores based on geographic, physical, and biological properties. Some methods, such as the Corps' Hydrogeomorphic Approach (Ref. 29), compare scores against corresponding "reference" wetlands. Other methods, such as the Florida Uniform Mitigation Assessment Method (Chapter 62-345 of the Florida Administrative Code) (Ref. 30), generate scores based on observed conditions.

The NRC encourages best professional judgment when selecting a functional assessment methodology. Environmental Concern, Inc., has summarized 40 separate functional assessment methodologies (Ref. 31). When selecting a methodology, applicants should consider regional suitability

and ease of use. The NRC also encourages informal consultation with State agencies and Corps districts to help identify the best methodology.

Summary of Common Useful Terrestrial Environmental Baseline Data

Table 3 summarizes some of the types of terrestrial baseline environmental data that are commonly helpful in supporting NRC licensing actions. The table provides separate information for new reactor licensing, relicensing of existing reactors, and decommissioning and covers applications for limited work authorizations. The text discusses the data in more detail.

Table 3. Types of Terrestrial Environmental Baseline Data and Utility for Reactor Licensing, Relicensing, and Decommissioning

DATA TYPE	DATA UTILITY		
	LICENSING	OPERATING LICENSE RENEWAL	DECOMMISSIONING
Land cover and land use data (various scales and sources)	• Site selection • Habitat impacts at the proposed site	Habitat impacts from refurbishment and operation	Habitat impacts in and outside operational areas due to large component removal and material storage
Reconnaissance-level data on species and habitats	• Site selection • Impacts to species and habitats at the proposed site	Impacts to species and habitats from refurbishment and operation	Impacts to species and habitats in and outside operational areas due to large component removal and material storage
Old habitat, botanical, and wildlife data collected previously in support of the licensing of existing facilities at the proposed site (i.e., use professional judgment to evaluate the utility of possibly obsolete data)	• Possible partial substitute for field surveys at the proposed site if the accuracy of old data is verified in the field • The planning of vegetation and wildlife surveys to augment old data at the proposed site • New and old data used to analyze impacts to habitats, vegetation, and wildlife	Impacts to habitats, vegetation, and wildlife from refurbishment and operation	Impacts to habitats, vegetation, and wildlife in and outside operational areas due to large component removal and material storage
Current habitat, botanical, and wildlife data collected in onsite field investigations	Impacts to habitats, vegetation, and wildlife	Impacts to habitats, vegetation, and wildlife	Impacts to habitats, vegetation, and wildlife
Site-specific Federally and State-listed species occurrence data from current field investigations	Impacts to Federally and State-listed species	Impacts to habitats, vegetation, and wildlife	Impacts to habitats, vegetation, and wildlife
Wetland delineation and functional assessment	Impacts to wetlands; completion of the CWA Section 404 application	Not usually needed unless new wetland impacts are anticipated	Not usually needed unless decommissioning activities proposed for naturally vegetated areas are outside of the former operations area
Locations of bald and golden eagle nests and roosting and foraging areas	Impacts to these species at the proposed site	Impacts to these species from refurbishment and operation	Impacts to these species in and outside operational areas due to noise and human activity associated with large component removal

Identifying Important Species and Habitats

Terrestrial environmental impact analyses for the NRC generally emphasize species and habitats meeting one or more importance criteria established by the agency (Ref 32). The criteria have been commonly used to address terrestrial and aquatic ecology impacts in NRC environmental documentation since the 1970s. Baseline data and natural resource agency consultations should form the basis for identifying specific important species and habitats. The following are criteria used by NRC at this time to identify important species and habitats:

- Federally listed threatened or endangered species and designated critical habitat under the Federal Endangered Species Act of 1973 (ESA) (Ref. 33). Although 50 CFR Part 17, "Endangered and Threatened Wildlife and Plants" (Ref. 34), undergoes periodic updates to present each officially listed species, the NRC encourages informal consultation with the agencies responsible for administration of the ESA. For most terrestrial species, that agency is FWS. Note: For some analyses, it may be necessary to distinguish between species and habitats on Federal land and those on non-Federal land.

- Species that are proposed or are candidates for Federal listing as threatened or endangered and a habitat that is proposed for designation as critical habitat. As for listed threatened or endangered species, informal consultation with the FWS is the best source of information. Note: For some analyses, it may be necessary to distinguish between proposed species and habitats on Federal land and those on non-Federal land.

- State-listed threatened or endangered species and species otherwise considered rare in the State (in contrast to species that are widespread, abundant, and secure). As for Federally listed species, informal consultation with State agencies is the preferred basis. State natural heritage programs may provide a listing of Federally listed species and State-listed and rare species that occur within specified buffers of a proposed site and transmission line corridors. The use of databases is encouraged, but direct communication with State regulators is still preferred. Impacts from facilities near State borders can extend to neighboring states; consultation with both affected States is encouraged. For sites near the Canadian or Mexican borders, consultation with appropriate foreign agencies may be appropriate.

- Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) regulated under the Bald and Golden Eagle Protection Act of 1940 (Ref. 35). Locations of bald and golden eagle nests and roosting and foraging areas are sometimes available from State wildlife agency nongame departments.

- Recreationally valuable species. Game species used for hunting are the obvious examples of important species under this criterion. Informal conversation with State game officials could identify species used for consumptive and nonconsumptive recreational uses. Increasingly, many areas, especially along coasts and bird migration routes, have derived substantial commercial benefits from recreational bird watchers. The inclusion of at least one bird species valued by bird watchers may be appropriate.

- Species essential to the maintenance and survival of species that are rare and recreationally valuable, as identified in the above bullets. Information may be available in scientific literature and from relevant Federal and State agencies. Consideration of habitat requirements and food web relationships is necessary. For example, the Federally endangered red-cockaded woodpecker (*Picoides borealis*) depends on large longleaf pine (*Pinus palustris*) trees where it can build nest

cavities. The Federally endangered Kirtland's warbler (*Dendroica kirtlandii*) depends on jack pine (*Pinus banksiana*) stands for habitat. Many shorebirds valued by bird watchers on the mid-Atlantic coast depend on horseshoe crab (*Limulus polyphemus*) eggs for food.

- Species that can serve as biological indicators to monitor the effects of the proposed action on the terrestrial environment. Some species are exceptionally sensitive to impacts and can serve as indicators of otherwise inconspicuous adverse conditions. For example, flowering dogwood (*Cornus florida*) and white ash (*Fraxinus americana*) have displayed visible injury when exposed to salt drift deposition rates substantially lower than those that produce visible symptoms in other trees (Ref. 30). Visible injury to these species could indicate less visible effects, such as growth reduction, in other plant species.

- National wildlife refuges, State wildlife areas, or other wildlife sanctuaries or preserves designated as such by State or Federal agencies. Examples include national and State parks and wildlife refuges. Although not formally designated by Federal or State agencies, lands owned by private conservation organizations, such as TNC or the National Audubon Society, might also be considered as important under this criterion.

- Wetlands (Executive Order 11990, "Protection of Wetlands," dated May 24, 1977 (Ref. 36)) and floodplains (Executive Order 11988, "Floodplain Management," dated May 24, 1977 (Ref. 37)). The delineation of wetlands is discussed above as a baseline investigation. The Federal Emergency Management Agency has mapped floodplains for many rivers and streams. Floodplains can also be mapped by independently performing hydraulic calculations based on local soils and precipitation data.

- Other habitats identified by State or Federal agencies as unique or rare or prioritized for protection. The NRC recommends informally meeting with agencies such as FWS and State conservation or game agencies. Some States have unique conservation agencies such as the water management districts in Florida, the Critical Areas Commission for the Chesapeake and Atlantic Coastal Bays in Maryland, and the New Jersey Pinelands Commission. The NRC also recommends informally speaking with potentially interested local agencies such as county or municipal planning and zoning departments, county wetlands boards, and town conservation commissions.

- Invasive species (Executive Order 13112 (Ref. 22)). Invasive plant species are alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. Invasive plant species include, but are not limited to, species on Federal or State noxious weed lists. Information may be available from the USDA cooperative extension service local or regional offices and relevant departments of the State's associated land-grant university.

The baseline studies described in the text sections above should form a generally adequate basis for identifying important species and habitats. However, it may be necessary to conduct specialized field searches to establish the presence or absence of certain important species. FWS has established specific field protocols for investigating sites for the presence of some threatened or endangered species and specific qualifications for field surveyors. Information on suitable methods for surveying other important species may be obtained from FWS or State agencies or from the scientific literature. Surveys should enumerate or estimate, where feasible, numbers of individuals observed of Federally listed species, species proposed or that are candidates for Federal listing, State-listed species, and species considered rare by the State.

Terrestrial Environmental Impact Analyses

Professional judgment is necessary to determine the types of terrestrial environmental impact analyses appropriate to an NRC licensing action. In general, the level of detail needed to evaluate impacts from new reactors is expected to be higher than that required for license renewal. Applicants should consult recent scientific literature and natural resource regulatory agencies for direction in planning impact analyses. This guide cannot anticipate all categories of terrestrial environmental impact analyses potentially appropriate to NRC licensing actions. However, the following general recommendations apply:

- Impact analyses should be based on the best available baseline data, whether collected specifically for the subject licensing activity or available from published sources, agency files, or communication with regional experts.
- Impact analyses should be clearly supported by data and logic.
- Impact analyses should be as quantitative as practicable.
- Impact analyses should use methodologies or models that are widely accepted by scientific authorities and natural resource regulatory agencies.
- Impact analyses should avoid use of experimental or unproven methodologies, assumptions, or models.
- Impact analyses should employ the best professional judgment and avoid unsupported speculation or opinion.

Habitat Loss Analyses

Clearing, grubbing, grading, inundation, and other site-preparation activities result in the loss of terrestrial habitats, including wetlands. Habitat losses can be quantified by overlaying the following:

a. a habitat map that outlines the spatial extent of the terrestrial habitats (including wetlands), and
b. a limits of disturbance plan that defines the proposed extent of ground surface and vegetation disturbance.

The limits of disturbance plan can be based on a formal grading plan or on a conceptual estimate of the bounds of vegetation or soil disturbance. The most accurate basis is a drawing depicting proposed grading overlaying existing topography. However, the outer limit of vegetation clearing may extend beyond the outer limit of grading. Vegetation clearing may also occur off site on rights-of-way or on locations for associated activities such as the excavation of borrow or disposal of dredged material.

Distinguishing between permanent and temporary habitat losses and distinguishing among habitat losses attributable to each major project element are both important. Impact analysis usually needs to extend beyond quantifying the acreage of habitat losses. It should evaluate the effects of habitat losses on the distribution, movement, and reproduction of flora and fauna.

Wildlife Noise Impact Analyses

Impact analyses should consider the possible effects of proposed short-term and long-term noise sources on terrestrial wildlife in surrounding habitats. Noise generated by the operation of cooling towers and the use of equipment such as bulldozers, chainsaws, backhoes, trucks, and jackhammers can influence wildlife in nearby undeveloped habitats. Noise can adversely affect wildlife physiology and behavior such as migration, feeding, reproduction, and communication. Analyses can compare projected noise levels in wildlife habitats near project sites with species noise tolerance levels reported in the scientific

literature. Responses reported in the literature vary widely among species and are a function of sound level (measured in decibels), sound duration, and pattern and frequency of occurrence (Refs. 38, 39, and 40). If quantitative noise data are not available in the scientific literature, qualitative evaluations may be substituted to account for the effects of existing background noise.

Wildlife Displacement Analyses

Impact analyses should consider how habitat loss and noise generation displace wildlife from affected habitats to nearby habitats. The receiving habitats may lack the resources necessary to accommodate the displaced wildlife, or the displaced wildlife may compete for limited resources with existing wildlife, resulting in net losses to affected populations. Habitats can optimally support only a certain population level, called the carrying capacity. Once the carrying capacity of habitats receiving displaced wildlife is exceeded, displaced individuals compete for resources until the population returns to the carrying capacity. Resource depletion during periods when the carrying capacity is exceeded can affect other species, thus disturbing delicate equilibriums that underlie food chains. In many areas of the United States, displacing species, such as the white-tailed deer (*Odocoileus virginianus*), resident Canada geese (*Branta canadensis*), or American alligators (*Alligator mississippiensis*), can lead to indirect impacts in nearby habitats such as heavy feeding on vegetation or forcing dangerous wildlife into sensitive urban settings like parks and playgrounds.

A qualitative discussion of possible wildlife displacement may be adequate. Applicants should confer with local, State, and Federal resource agencies. Analyses can include a discussion of possible mitigation measures such as regional habitat improvement projects to accommodate displaced wildlife or the use of hunters or trappers to reduce wildlife populations before habitat disturbance.

Bird and Bat Collision Analyses

Birds and bats can collide with any structure while in flight, but the primary collision risk is from structures exceeding 200 feet above ground level. This is the minimum elevation for which the U.S. Department of Transportation's Federal Aviation Administration requires aircraft warning lights. Lights attract night-migrating birds and bats to the airspace around the structure, where they are physically injured by collision with the structure or the supporting guy wires (Ref. 41). Collisions are most probable in fog, mist, or low clouds during the bird and bat migration seasons. The cumulative impact from the hundreds of recently constructed communications towers is suspected in playing a role in population declines for several migratory bird species, such as the cerulean warbler (*Dendroica cerulea*) (Ref. 41).

Impact analyses should discuss the potential effects on populations of migratory bird species colliding with any proposed structure exceeding the 200-foot (61 meters) threshold. NUREG-1437 (Rev 0), "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," issued May 1996 (Ref. 42), summarizes the quantitative data of bird collisions with natural draft cooling towers in operation at several nuclear reactors before 1991. Applicants should also consider more recent, relevant data, including those published for other types of tall structures.

The impact assessment may be qualitative, but it should address the cumulative impacts on populations of potentially affected bird and bat species from the proposed nuclear plant and from other tall structures in the region, including transmission lines. The analysis should consider site-specific factors such as occurrence of the site along coasts, near other high-quality bird habitats, or on migration flyways.

Avian Electrocution Analyses

The electrical design factor most crucial to avian electrocutions is the physical separation between energized structures or energized and grounded structures, hardware, or equipment that birds can bridge to complete a circuit. Electrocutions occur with raptors, colonial water birds, and other birds on structures where phase conductors or grounded hardware and phase conductors are separated by less than the wrist-to-wrist or head-to-foot distances of a bird (Ref. 43).

The impact of electrocutions on avian populations is poorly understood (Ref. 42). Nevertheless, electrocution is a well-documented source of mortality (Ref. 43) and should be analyzed in terms of the species status locally and regionally (e.g., rare or declining versus widespread and abundant). The applicant should take into consideration applicant commitments to implement conductor-to-conductor and conductor-to-structure separation distances, as recommended by the Avian Power Line Interaction Committee (Ref. 43), or to place transmission towers and lines outside of areas heavily used by birds (e.g., nesting and staging areas). The impact assessment may be qualitative, but it should address the effects on bird species from the proposed transmission systems.

Cooling Tower Drift Analyses

Operation of cooling towers releases plumes of water vapor and droplets of condensed water to the atmosphere. The plume generally travels farther from taller natural draft cooling towers than it does from lower mechanical draft towers. Water circulating through cooling towers never comes in contact with the reactor core; therefore, radioactive contamination in drift is not a concern. However, drift carries dissolved salts, biocides, and other constituents. Salts originate from makeup (source) water and become concentrated as water evaporates inside the tower. Brackish makeup water is of greater concern than fresh makeup water. Biocides are used to control microorganisms in the water. Flora and fauna near cooling towers are exposed to drift, including salts and biocides. Fogging from drift elevates the humidity experienced by flora and fauna. In cold temperatures, drift can freeze to form ice on vegetation.

Based on studies summarized in NUREG-1437 (Rev 0), the NRC recommends preparing a graphic that overlays projected salt deposition isopleths on the terrestrial habitat map wherever projected deposition exceeds 1 kilogram per hectare per month. Applicants should search scientific literature for any recently published data on plant responses to salt deposition. The NRC also recommends a more detailed analysis if deposition rates in naturally vegetated terrestrial habitats exceed 10 kilograms per hectare per month. In some settings, qualitative analyses are adequate to assess potential impacts to terrestrial habitats from the fogging and icing caused by cooling tower drift. In other settings, such as in arid climates where fogging could generate unnatural humidity levels or in areas dominated by evergreen trees prone to ice breakage, quantitative analyses may be more appropriate.

Analyses for Hydrological Impacts to Terrestrial Habitats

Construction dewatering activities and water withdrawal during operations, including withdrawal of surface water or groundwater for cooling water, can affect the quality of terrestrial habitats. Groundwater withdrawal can lower the water table, thereby shrinking or eliminating wetlands. Site preparation can also alter surface runoff patterns by directing water that once drained to depressional wetlands into stormwater management facilities. In arid areas, cones of depression resulting from groundwater withdrawals can convert mesic forest and scrub-shrub upland habitats, which are common in floodplains and arroyos, into desert habitats. Although terrestrial ecologists do not perform hydrological modeling, they should attempt to work with hydrologists to quantify hydrological alterations to any wetlands, mesic lowlands, and other hydrologically sensitive terrestrial habitats.

Terrestrial Environmental Monitoring

Most terrestrial environmental monitoring requirements are derived from environmental permits, the ESA, and State regulations that protect rare species. Biological opinions issued by FWS or the National Marine Fisheries Service (collectively referred to as "the Services") under the ESA may call for the monitoring of areas containing threatened or endangered species or the evaluation of the success of mitigation actions to relocate or protect those species. The Services or permits may outline specific monitoring and reporting protocols. If not, the NRC recommends contacting the Services or responsible permitting agency for the following individualized direction:

a. seasonal timing of monitoring visits,
b. field data collection procedures,
c. sampling approaches (e.g., use of sample quadrats or transects),
d. field equipment specifications,
e. qualifications of field personnel, and
f. reporting requirements.

Decommissioning

NUREG-0586, "Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," Supplement 1, "Regarding the Decommissioning of Nuclear Power Reactors," issued November 2002 (Ref. 44), summarizes the potential impacts that the decommissioning of nuclear reactors could have on terrestrial environmental resources. Decommissioning does not usually result in significant adverse ecological effects when ground disturbance is limited to the former operational area. However, it may be helpful to characterize ecological conditions before site development when managing ecological resources on decommissioned sites. Potentially significant impacts are possible, however, when ground disturbance from decommissioning activities extends to naturally vegetated areas outside of the former operational area. Many of the same terrestrial environmental baseline and impact analyses described above could help support the review of decommissioning impacts affecting naturally vegetated areas.

C. STAFF REGULATORY GUIDANCE

1. Because precise predictions and assessments of impacts on terrestrial ecological systems are not always possible, reasonable professional interpretations are recommended when quantitative prediction is not practicable.

2. Professional judgment is needed to identify appropriate analytical methods to support NRC licensing actions. Applicants should contact Federal, State, and local regulatory agencies and search recent scientific literature for specific analytical protocols.

3. Baseline investigations should be broad enough and completed early enough to support anticipated impact analyses and monitoring that might be required by federal and state agencies. These investigations may be prepared as separate reports or presented as part of larger documents such as environment reports. Closely related baseline studies and analyses can be combined into single reports.

4. Terrestrial habitats should be labeled on maps using names based on indicator species or habitat or land cover naming systems developed for statewide or nationwide use. Wetlands should be identified using a widely recognized wetland nomenclature system. Each vegetative stratum in

each habitat should be described.

5. Wetland delineations for projects involving ground disturbance should be completed using routine Federal and State protocols. Wetland delineation reports should include a functional assessment.

6. Applicants who can identify common plants and wildlife should visit project sites multiple times during the growing season. When possible, they should time their visits to coincide with flowering seasons, bird migration seasons, and amphibian calling seasons. The applicants should develop tables listing observed species with information on distribution and abundance.

7. Terrestrial environmental impact analyses should focus primarily on species meeting NRC importance criteria (Ref 32). Specialists may need to conduct site visits at specific times of the year to determine whether important species are present and, if so, subject to impact.

8. Habitat losses should be quantified by overlaying the estimated limits of disturbance over a habitat map. Losses of jurisdictional and nonjurisdictional wetlands should be considered.

9. Estimated salt drift isopleths from cooling towers should be plotted on a base map showing terrestrial habitats.

10. Other terrestrial environmental impact analyses that may be needed to support NRC licensing decisions include the following:

    (1) noise impacts on wildlife,
    (2) interruptions in wildlife movement and migration patterns,
    (3) introduction and expansion of coverage by pests and invasive species,
    (4) the potential for displaced wildlife to exceed the carrying capacity in nearby habitats,
    (5) the potential for bird and bat collisions with elevated structures,
    (6) the potential for electrocution of birds, and
    (7) hydrological effects on wetlands and other terrestrial habitats.

11. Terrestrial environmental monitoring required by environmental permits or regulations should be carefully planned with responsible regulatory agencies.

12. Terrestrial environmental baseline studies and impact analyses may be necessary for decommissioning activities that disturb naturally vegetated lands outside of the former operational area.

D. IMPLEMENTATION

The purpose of this section is to provide information on how applicants and licensees[1] may use this guide and information regarding the NRC's plans for using this regulatory guide. In addition, it describes how the NRC staff complies with the Backfit Rule (10 CFR 50.109) and any applicable finality provisions in 10 CFR Part 52.

Use by Applicants and Licensees

Applicants and licensees may voluntarily[2] use the guidance in this document to demonstrate compliance with the underlying NRC regulations. Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations. Current licensees may continue to use guidance the NRC found acceptable for complying with the identified regulations as long as their current licensing basis remains unchanged.

Licensees may use the information in this regulatory guide for actions which do not require NRC review and approval such as changes to a facility design under 10 CFR 50.59. Licensees may use the information in this regulatory guide or applicable parts to resolve regulatory or inspection issues.

Use by NRC Staff

During regulatory discussions on plant specific operational issues, the staff may discuss with licensees various actions consistent with staff positions in this regulatory guide, as one acceptable means of meeting the underlying NRC regulatory requirements. Such discussions would not ordinarily be considered backfitting even if prior versions of this regulatory guide are part of the licensing basis of the facility. However, unless this regulatory guide is part of the licensing basis for a facility, the staff may not represent to the licensee that the licensee's failure to comply with the positions in this regulatory guide constitutes a violation.

If an existing licensee voluntarily seeks a license amendment or change and (1) the NRC staff's consideration of the request involves a regulatory issue directly relevant to this new or revised regulatory guide and (2) the specific subject matter of this regulatory guide is an essential consideration in the staff's determination of the acceptability of the licensee's request, then the staff may request that the licensee either follow the guidance in this regulatory guide or provide an equivalent alternative process that demonstrates compliance with the underlying NRC regulatory requirements. This is not considered backfitting as defined in 10 CFR 50.109(a)(1) or a violation of any of the issue finality provisions in 10 CFR Part 52.

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this regulatory guide. The NRC staff does not expect any existing licensee to use or commit to using the guidance in this regulatory guide, unless the licensee makes a change to its licensing basis. The NRC staff does not expect or plan to request licensees to voluntarily adopt this regulatory guide to resolve a generic regulatory issue. The NRC staff does not expect or plan to initiate NRC regulatory action which

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[1] In this section, "licensees" refers to licensees of nuclear power plants under 10 CFR Parts 50 and 52; and the term "applicants," refers to applicants for licenses and permits for (or relating to) nuclear power plants under 10 CFR Parts 50 and 52, and applicants for standard design approvals and standard design certifications under 10 CFR Part 52.

[2] In this section, "voluntary" and "voluntarily" means that the licensee is seeking the action of its own accord, without the force of a legally binding requirement or an NRC representation of further licensing or enforcement action.

would require the use of this regulatory guide. Examples of such unplanned NRC regulatory actions include issuance of an order requiring the use of the regulatory guide, requests for information under 10 CFR 50.54(f) as to whether a licensee intends to commit to use of this regulatory guide, generic communication, or promulgation of a rule requiring the use of this regulatory guide without further backfit consideration.

Additionally, an existing applicant may be required to adhere to new rules, orders, or guidance if 10 CFR 50.109(a)(3) applies.

Conclusion

This regulatory guide is not being imposed upon current licensees and may be voluntarily used by existing licensees. In addition, this regulatory guide is issued in conformance with all applicable internal NRC policies and procedures governing backfitting. Accordingly, the NRC staff issuance of this regulatory guide is not considered backfitting, as defined in 10 CFR 50.109(a)(1), nor is it deemed to be in conflict with any of the issue finality provisions in 10 CFR Part 52.

If a licensee believes that the NRC is either using this regulatory guide or requesting or requiring the licensee to implement the methods or processes in this regulatory guide in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfit appeal with the NRC in accordance with the guidance in NUREG-1409 and NRC Management Directive 8.4.

The purpose of this section is to provide information to applicants for nuclear power reactor construction permits, early site permits and combined licenses on how applicants may use this regulatory guide. It also provides information for construction permit and early site permit holders regarding the NRC staff's plans for using this regulatory guide.

The methods described in this regulatory guide will be used in evaluating applications for construction permits, early site permits, combined licenses, and limited work authorizations, which includes information under 10 CFR 51.49(b) or (f), with respect to compliance with applicable regulations governing the siting of new nuclear power plants. Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations.

The NRC's consideration of the information provided by (i) the applicant for, or the holder of, an operating license, (ii) the holder of an early site permit who subsequently seeks, under 10 CFR 52.27, a limited work authorization under 10 CFR 50.10, and (iii) the holder of a combined license, is not a "siting" determination. Therefore, such NRC consideration is neither backfitting nor an action inconsistent with the applicable issue finality requirements in 10 CFR Part 52.

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2. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," U.S. Nuclear Regulatory Commission, Washington, DC.

3. 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, Washington, DC.

4. Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Stations, Revision 2, U.S. Nuclear Regulatory Commission, Washington, DC, July 1976.

5. Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations, Revision 2, U.S. Nuclear Regulatory Commission, Washington, DC, April 1998.

6. 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," U.S. Nuclear Regulatory Commission, Washington, DC.

7. EPRI Report No. 1006878, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," Electric Power Research Institute, Palo Alto, CA, 2002.[4]

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[3] Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public Web site at: http://www.nrc.gov/reading-rm/doc-collections/. The documents can also be viewed on-line or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail pdr.resource@nrc.gov.

[4] Copies of the listed Electric Power Research Institute (EPRI) standards and reports may be purchased from EPRI, 3420 Hillview Ave., Palo Alto, CA 94304; telephone (800) 313-3774; fax (925) 609-1310.

8. Clean Water Act of 1977, 33 USC 1251 et seq.

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10. 33 CFR Part 325, "Processing of Department of the Army Permits," U.S. Army Corps of Engineers, Washington, DC.

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20. "Federal Manual for Identifying and Delineating Jurisdictional Wetlands," Cooperative Technical Publication issued by the Federal Interagency Committee for Wetland Delineation: U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture Soil Conservation Service, Washington, DC, 1989.

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