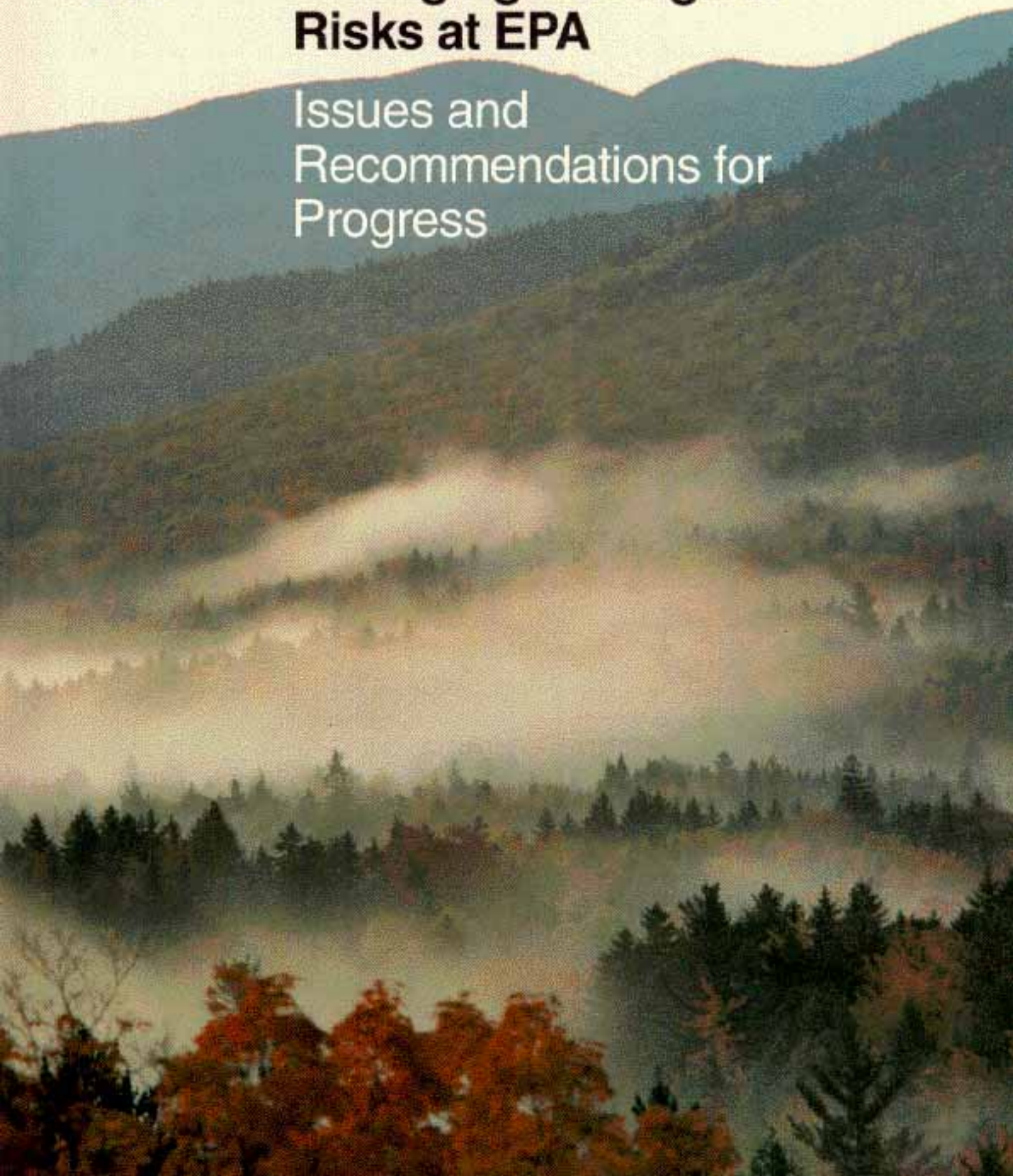




Managing Ecological Risks at EPA

Issues and Recommendations for Progress



Managing Ecological Risks at EPA: Issues and Recommendations for Progress

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Executive Summary

Introduction

Since its inception in 1970, the U.S. Environmental Protection Agency (EPA) has focused more consistently on protecting human health than ecosystems. In recent years, however, the Agency has worked to address this imbalance. For example, EPA has set priorities that emphasize the value of ecosystems as well as human health and welfare, and has made an increasing number of regulatory decisions that incorporate ecological concerns. Nevertheless, limited consensus exists within EPA on objectives for ecological protection. A consistent focus on ecosystem protection requires clear Agency-wide guidance on what ecosystems and ecosystem components should be protected and to what degree, and what regulatory endpoints should be used in ecological risk assessment and risk management decisions. This report is intended to assist in the development of that guidance by presenting ecological concerns already considered in several of EPA's program areas.

Background

This report stems from issues identified during the development of EPA's *Framework for Ecological Risk Assessment* (U.S. EPA, 1992a), the Agency's initial guidance for conducting ecological risk assessment. In May 1991, during a scientific peer review of the *Framework*, several scientists from academia, government, and industry reached a consensus opinion that:

... policy and risk management issues must play an important part in guiding the ecological risk assessment process to ensure that relevant societal concerns are adequately addressed (U.S. EPA, 1992b).

Afterwards, senior managers and scientists having risk assessment responsibilities within the Agency agreed that EPA had not yet established management guidance or standard policies for conducting ecological risk assessments, and that the success of ecological risk assessment depended on such guidance.

To provide this needed policy guidance for ecological risk assessments, EPA conducted a survey between August 1992 and March 1993 to document the Agency's current and historical ecological concerns as expressed by Agency decisions. This report summarizes the results of that survey. The goals of the report are to:

- Summarize the ecological concerns historically used in EPA decision-making.

- Provide background information for future guidance on risk management and on establishing guiding principles for developing, describing, and using ecological risk assessments at EPA.
- Provide a set of recommendations to improve ecological considerations in EPA decision-making.

This report may also be useful for other ecological efforts currently under way in the Agency. Examples include efforts to advance the concept of ecosystem or "place-based" management (U.S. EPA, 1994a), to respond to the ecological recommendations of the Vice President's National Performance Review (U.S. EPA, 1993b), to set national goals for environmental protection (U.S. EPA, 1994d), and to strengthen EPA's commitment to protecting endangered species (U.S. EPA, 1993d, 1994b).

Major Findings

Ecological Concerns Used in Past Agency Decisions

EPA program offices use a variety of ecological concerns in their decisions. The survey revealed the following about EPA's ecological concerns:

- Acute mortality appears to be one of the most frequently and widely used ecological effects of concern in EPA program decisions.
- Available toxicity data (such as LD₅₀ and LC₅₀ laboratory test results) appear to strongly influence what is of ecological concern at EPA.
- In general, animals (e.g., birds and fish) are more frequently assessed as a value of ecological concern than plants.
- All program areas consider chemical stressors and impacts.
- Biological stressors considered tend to be exotic or non-native species (e.g., zebra mussels).
- Physical stressors have been considered with respect to dredge-and-fill activities and the review of environmental impact statements for large federal projects.
- No office has set a quantitative threshold representing an unacceptable risk to nonhuman organisms

(e.g., analogous to a 1×10^{-6} cancer risk for human health).

- Except for endangered species, no case was found where an individual nonhuman organism, or even a small number of individuals, was protected by a regulatory decision.
- EPA typically does not consider dynamic parameters such as birth, death, immigration, and emigration rates in nonhuman populations. When population is considered, the focus is usually on the possible decline or extinction of a local population at a particular site.
- Some programs consider effects to multiple species (e.g., as implicit in the use of Ambient Water Quality Criteria). Typically, however, EPA does not consider interactions among species (e.g., predator–prey relationships). Many EPA offices generally assume that protecting individual species will protect a population or community. This assumption is a subject of scientific debate.
- EPA pays considerable attention to protecting wetlands, estuaries, and large natural resources such as the Chesapeake Bay, the Great Lakes, and the Gulf of Mexico. Generally, however, when evaluating risks to ecosystems, the Agency does not consider interactions occurring among animal and plant communities and their physical environment.

Issues, Needs, and Suggestions for Improving Ecological Considerations at EPA

Responses to questions about needs and suggestions for improving considerations of ecological risk fell into seven categories:

Policy Guidance

More than three-fourths of the programs interviewed expressed the need for clear ecological policy guidance within EPA. Respondents identified the following types of guidance needed for effective risk assessments: guidance on the relative value EPA should place on different types of ecosystems or ecosystem components; guidance on whether to focus on chemical, physical, and/or biological stressors and whether to protect individuals, populations, communities, and/or entire ecosystems or landscapes; and guidance on how to make tradeoffs between ecological risks and human health/welfare risks.

Technical Guidance and Support

More than half the offices interviewed stressed the need for technical support and guidance for conducting ecological risk assessments. Many programs appear to favor step-by-step, program-specific guidance on methods and tools useful for assessing ecological risks.

Ecological Expertise

More than half the programs interviewed urged EPA to acquire more ecological expertise. Several programs noted the disproportionate number of ecologists with training in aquatic as opposed to terrestrial systems, and recommended that EPA develop more expertise in terrestrial (e.g., forest and wildlife) biology and ecology.

Information and Data

More than half of all the programs interviewed, and nearly three-fourths of the Headquarters offices interviewed, stated that ecological risk management decisions are limited by a lack of ecological data. Issues raised included inconsistencies in the amount and type of ecological data required at the management level for decision-making; limited access to ecological information; dependence on other federal agencies for information used in making EPA decisions; lack of quality assurance/quality control, a high level of uncertainty, or difficulty in interpreting data; and a lack of ecological risk criteria.

Agency Culture

More than a third of the programs interviewed stated that office or Agency culture (i.e., EPA's tradition of protecting human health) limits ecological considerations at EPA.

Authorities and Roles

Some of those interviewed—one-third of the Regional programs and one-fifth of the Headquarters programs—asserted that EPA needs to define its role in protecting ecological resources. Several programs recommended that EPA clearly define its role in relation to other Federal agencies (e.g., public land management agencies in the Departments of Interior, Agriculture, Commerce, and Defense).

Fiscal Resources

One-tenth of the Regional programs and one-third of the Headquarters programs interviewed expressed the need for additional fiscal resources to improve ecological considerations at EPA.

Recommendations

This report offers eight recommendations for improving ecological considerations in EPA decision-making. The authors formulated these recommendations through analysis and interpretation of their interviews with the EPA Headquarters and Regional program offices. It is anticipated that these recommendations will be further developed and refined as they are reviewed and discussed within and outside the Agency.

Recommendation 1: Ensure an appropriate balance between ecological, human welfare, and human health concerns in Agency regulations and policy.

The Agency should take advantage of the opportunities presented by many of its current activities to give appropriate attention to ecological and human welfare/natural resource concerns. Some examples include regulation of pollution by the program offices; decision-making about dredge-and-fill activities and large federal projects; and priority setting through the Agency's new Tiering Process for Regulatory and Policy Development.

Recommendation 2: Develop common Agency-wide ecological concerns.

EPA needs to establish an initial, overall set of ecological concerns to be considered in all Agency activities, including the development of regulations, policies, and assessment endpoints for ecological risk assessments. These concerns can take the form of Agency-wide principles or objectives and can also support other ecosystem management and nonregulatory efforts being undertaken by the Agency.

Recommendation 3: Encourage an open process for developing Agency-wide ecological concerns.

Several EPA programs and projects have successfully adopted an open process that involves the public, natural resource trustees, or other stakeholders in identifying concerns and establishing goals for environmental protection. Examples include the Superfund program, the Office of Water's "Watershed Protection Approach," and the National Goals Project. These open processes appear to promote cross-media efforts within EPA and enhance public support for reducing ecological risks.

Recommendation 4: Specify rationales and establish precedents for ecological protection decisions.

EPA has less precedent for protecting ecological resources than for protecting human health. The Agency should therefore consider documenting its ecological decisions, including the rationales for those decisions, on an ongoing basis. Where the Agency finds strong scientific and societal justification for an ecological decision, it can consider using that decision as a precedent for similar future decisions (but should not be constrained

by the past in developing sound, new approaches for making better ecological decisions).

Recommendation 5: Set up formal processes to ensure effective interaction between risk managers and assessors during the process of ecological risk assessment.

Participation by EPA's risk managers in the risk assessment process, particularly during the scoping phase, is essential to producing scientifically sound assessments relevant to management decisions and public concerns.

Recommendation 6: Develop ecological risk management guidance and training; recruit additional staff with ecological expertise.

Guidance and training for EPA risk managers, assessors, and other staff are essential to support the Agency's sharpening focus on ecological risk assessment. This guidance and training will need to meet several different goals: ensuring that ecological risk assessments provide optimum information for making risk management decisions, promoting consistency in ecological risk assessment across EPA programs, and fostering successful dialogue between risk managers and risk assessors. EPA should also consider recruiting additional trained ecologists, biologists, ecotoxicologists, and other scientists to strengthen EPA's base of ecological expertise.

Recommendation 7: Improve ecological risk communication.

Another key Agency need is better communication within and outside EPA about ecological risks and decisions. Training, recruitment, and project planning are needed to improve EPA's ability to communicate ecological risk information to the Agency decision-makers and the outside world.

Recommendation 8: Explore, develop, and apply new scientific tools for ecological risk assessment and new economic tools for making ecological risk management decisions.

Also key to the success of EPA's evolving emphasis on ecological risk assessment are advances in scientific and economic methods and data. EPA program managers and scientists alike should help plan for the next generation of technological advances required for better assessment of ecological risks.

Chapter 1

Introduction

This report is intended to assist efforts to identify clearer, Agency-wide objectives for ecological protection by presenting baseline information about historical concerns considered in EPA's program areas (e.g., concerns about specific ecosystems and ecosystem components such as wetlands and wildlife species). This report is also intended to help risk managers and assessors develop ecological assessment endpoints during the problem formulation stage of ecological risk assessment (see Chapter 2). In addition, the report may complement new ecological initiatives at EPA, including efforts to advance the concept of ecosystem or "place-based" management (U.S. EPA, 1994a), respond to the ecological recommendations of the Vice President's National Performance Review (U.S. EPA, 1993b), set national goals for environmental protection (U.S. EPA, 1994d), and strengthen EPA's commitment to protecting endangered species (U.S. EPA, 1993d, 1994b).

The report places particular emphasis on ecological concerns that have been used in at least one program decision (e.g., as evidenced in Federal Register notices of proposed or final rules, policy statements, guidance documents, strategic plans, memoranda, testing protocols, standard operating procedures, or economic analyses).¹ It identifies common ecological concerns used across EPA's program areas as well as those unique to specific programs. The report also provides suggestions from program areas and recommendations for improving ecological considerations within the Agency. This information on ecological concerns and program needs was gathered during a series of interviews conducted with staff representing more than 40 different program areas thought to consider ecological risk in their activities. Appendix A describes the methods used to obtain and analyze this information.

This report is not intended to be an all-encompassing or definitive survey of EPA's ecological activities or concerns. The authors did, however, strive to capture as

many ecological concerns expressed by Headquarters and Regional programs as possible. The remainder of this chapter includes a brief historical perspective of how ecological protection has evolved at EPA (Section 1.1) and describes how the rest of the report is organized (Section 1.2).

1.1 Brief Historical Background of Ecological Protection at EPA

In the late 1960s and early 1970s, environmental concerns about unhealthy air conditions, rivers in flames, massive oil spills, and persistent pesticides contributed to the first Earth Day and the creation of the U.S. Environmental Protection Agency (EPA) (U.S. EPA, 1988a; Russell, 1994). Since that time, Congress has charged EPA to interpret and implement language found in several major statutes designed, for example, to protect and enhance the quality of the nation's air resources (Clean Air Act); restore and maintain the chemical, physical, and biological integrity of the nation's waters (Clean Water Act); prevent unreasonable adverse effects from the use of pesticides (Federal Insecticide, Fungicide, and Rodenticide Act); regulate the manufacture and use of chemicals (Toxic Substances Control Act); regulate solid and hazardous waste (Resource Conservation and Recovery Act); clean up releases of hazardous substances to the environment (CERCLA or "Superfund"); and assess the environmental impact of major federal projects (National Environmental Policy Act) (McClain, 1991).

Most of these statutes have a common theme of "protecting human health and the environment." The Agency, however, has focused more consistently on protecting human health than other environmental problems, such as risks to ecosystems and human welfare. Although EPA has done much to clean up gross pollution in the environment (U.S. EPA, 1988a), the Agency's focus on human health has not always protected ecosystems and natural resources which humans and other species depend on for their continued survival.

Looking back over EPA's first two decades, some feel that the Agency made a clear choice to define environmental protection early on as protecting human health

¹ Ecological "concerns" or "considerations," as defined by this study, include valued ecosystems or ecosystem components that formed a partial or whole basis for a regulatory decision or a decision to pursue some other programmatic objective or activity (e.g., a cooperative, nonregulatory effort to protect or reduce risks to a particular species or ecosystem).

(e.g., Landy et al., 1990). Within EPA, others feel that the Agency's focus on human health rather than ecological concerns was not so much a conscious choice as it was an application of Agency resources to areas that appeared to be most important at the time to Congress, the courts, and the public. In this view, where specific ecological problems were evident (e.g., with pesticides such as kepone, mirex, and DDT), action was taken, and that the traditional focus on human health is more of an imbalance rather than a disregard for ecological issues. Another view is that EPA shifted its focus from environmental to human health ills in the early 1970s in large part because methods (such as cancer risk assessment guidelines) had evolved that made it possible to win health-based cases in court.

Not until the late 1980s did ecological concerns begin to figure more prominently in EPA's interpretation of "protect[ing] . . . the environment." This new course was evidenced by two efforts, one by EPA and the other by the Agency's external Science Advisory Board (SAB), which comparatively ranked various environmental problems facing the nation. In short, EPA's *Unfinished Business* report (U.S. EPA, 1987) led to a series of SAB reports, beginning with *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (U.S. EPA, 1990a). In two of these reports (U.S. EPA, 1990a, b), the SAB stressed the following:

- Human health and welfare ultimately rely on the life support systems and natural resources provided by healthy ecosystems.
- The value of natural ecosystems is not limited to their immediate utility to humans. They have an intrinsic, moral value that must be measured in its own terms and protected for its own sake.
- EPA should communicate to the general public a clear message that the Agency considers ecological risks to be as serious as human health and welfare risks.
- EPA should set Agency risk-based priorities with an appropriate balance between ecological, human health, and welfare concerns.

Since that time, ecological concerns have increasingly appeared in new mission-type statements for the Agency; for example:

- [EPA endeavors] to preserve and improve the quality of the environment, protect human health, and safeguard the productivity of natural resources on which all humans depend (U.S. EPA, 1991).
- EPA is charged by Congress to protect the nation's land, air, and water systems . . . [and] formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life (U.S. EPA, 1993d).

- [EPA] will improve the overall ecological health of the environment by protecting the physical, chemical, and biological components and processes of ecosystems . . . , maintain[ing] and restor[ing] representative examples of ecosystems, habitat types and . . . connections across landscapes, and biological communities, and ensur[ing] viable populations of native plants and animals, well distributed throughout their range, and the genetic variability within those populations (U.S. EPA, 1994d).

Program offices have also made advances in incorporating ecological concerns in regulatory decisions. Examples include the following two policy statements about activities regulated by EPA's Office of Pesticide Programs and Office of Water:

- [A]bsent some countervailing benefit of continued [pesticide] use, as a matter of policy an unnecessary risk of regularly repeated bird kills will not be tolerated (Former Administrator William Reilly's Decision Canceling Certain Uses of Diazinon, July 13, 1990).
- A mitigation sequence of avoiding, minimizing, and as a last resort, compensating wetland losses will be applied to the review of Section 404 permit projects. (Memorandum of Agreement between EPA and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines, February 6, 1990).

Most of the above statements reflect a growing awareness that solely protecting human health does not necessarily protect ecosystem resources or public welfare. Nonetheless, they are quite general, and risk assessors and managers typically require more specific information to apply in Agency risk assessments and decisions (e.g., What types of birds or wetlands should be protected? What types of adverse effects should be of concern?). They also provide insufficient direction to the program areas for setting criteria and standards to protect environmental quality.

At present, it appears that EPA will continue to develop capabilities in ecological protection, as evidenced by the current Administration's stated priorities and recommendations for change in the Agency (U.S. EPA, 1993a). Examples include initiatives to bring EPA's media-specific programs "together in a coordinated ecosystem protection manner" (U.S. EPA, 1993c), to develop "a proactive approach to ensuring a sustainable economy and sustainable environment through ecosystem management" (U.S. EPA, 1993b), to "protect not only endangered species but the ecosystems on which these species depend" (U.S. EPA, 1993d), and to ensure that "issues threatening the sustainability of ecosystems . . . drive the Agency's agenda" (U.S. EPA, 1994a). Other than endangered species, however, no effort in the Agency is known to determine specific ecosystems or

ecosystem components that EPA should protect on a consistent basis and to what degree.

1.2 Organization of This Report

The remainder of this report presents the ecological concerns historically used in EPA decisions (Chapter 2), summarizes comments received from program areas on improving ecological considerations within the Agency (Chapter 3), and recommends next steps for improving ecological risk management at EPA (Chapter 4).

Appendices are also included that provide the following information: methods (Appendix A) and interview questions (Appendix B) used in the survey, a list of participating Regional and Headquarters program areas (Appendix C), detailed discussion and tables of ecological concerns identified by the survey (Appendix D), additional comments from the analysis summarized in Chapter 3 (Appendix E), and summaries of each interview, including a description of program decisions, statutory authorities, and ecological concerns used in decisions (Appendix F).

Chapter 2

Ecological Concerns Historically Used in EPA Decisions

2.1 Introduction

In general, EPA's ecological concerns derive from statutory mandates, EPA's interpretations of these mandates (e.g., regulations), judicial interpretations, and the exercise of judgment and choices made by EPA's decision-makers over the years. The Agency concerns identified by this survey (Table 2-1) have largely been shaped within an atmosphere of limited consensus on what is ecologically significant (i.e., in a sociopolitical context) and on what constitutes an intolerable adverse ecological effect (i.e., an effect that may require regulatory consideration or action). Most of the concerns identified in Table 2-1 also derive from EPA's:

- Frequent need for rapid, screening-level types of analyses.
- Use of single-species laboratory toxicology data on chemicals rather than other ecological data in determining ecological effects and levels of concern.
- Tendency to generate ecological risk assessments from a single, media-specific program office independent from others. (EPA's program offices infrequently collaborate with each other on regulatory assessments and actions.)
- Focus on either a local or, at the other extreme, national scale (although watershed and regional approaches are becoming more popular).

The alphabetized range of valued ecological systems and components have been documented by this report as being considered in at least one EPA decision. The associated adverse effect(s) of concern is also stated if it is known. Parentheses following several of the valued ecological systems and components listed in the table provide adjectives or other descriptive terms that summarize, in more detail, a range of related concerns also documented as being used in an EPA decision.

The ecological concerns compiled in Table 2-1 were collected from across the entire Agency. The table is intended to show a range of ecological concerns used in past Agency decisions. Additional information is provided in Section 2.2 and Appendix D (Tables D-1 and D-7).

One way in which this list of concerns can benefit EPA is as a starting point for developing "assessment endpoints" for ecological risk assessments. Very few Regional or program offices have identified assessment endpoints as defined by the *Framework for Ecological Risk Assessment* (U.S. EPA, 1992a). The *Framework* defines assessment endpoints as "explicit expression[s] of the environmental value that is to be protected." Many of those in the field of ecological risk assessment recommend that defining an assessment endpoint (i.e., an "explicit expression . . .") involves two steps, as suggested by Suter (1989):

Step 1 Identifying the valued attributes of the environment that are considered to be at risk [e.g., migratory birds or game fish potentially exposed to a pesticide, toxic chemical, or solid or hazardous waste].

Step 2 Defining these [valued] attributes in operational terms [e.g., Does the proportion of migratory birds killed within the polluted region exceed that of other similar, but less polluted regions (i.e., reference areas)? Is it likely that a 10-percent or more reduction in game fish production will occur?].

Many of the ecological concerns identified in this study satisfy the first step in defining an assessment endpoint. Some "valued attributes of the environment" (Suter, 1989) or "environmental value[s] . . . to be protected" (U.S. EPA, 1992a) can be found in or derived from EPA's environmental statutes. Many of EPA's statutes, however, do not provide specific language about ecological concerns to incorporate in EPA decisions. For example, nonspecific language such as "protect the environment" (found in most of EPA's statutes) and "protect the chemical, physical, and biological integrity of the nation's waters" (in the Clean Water Act) provides little specific guidance on what EPA should value and consider from an ecological standpoint in its analyses and decisions. Nevertheless, it is important to note that EPA is limited only by its own creativity in interpreting its broadly defined statutes more specifically for purposes of ecological protection (Environmental Law Institute, 1991). Several reports are available that describe legislative authorities for protecting habitats,

Table 2-1. Examples of Ecological Concerns Used in EPA Decisions

#	Valued Ecological System or Component	Concern(s)
1	Algae	Acute and chronic effects; expected exceedance of an aquatic "concentration of concern"
2	Amphibians or reptiles ("of special interest")	Not specified
3	Benthic communities, invertebrates, and organisms	Acute and chronic effects; sediment contamination
4	Biological diversity (terrestrial and aquatic; preservation of)	Not specified
5	Birds (migratory birds, waterfowl, nesting habitat, flyways)	Acute mortality (recurring incidents of bird kills); chronic and potential adverse effects
6	Coastal barriers	Not specified
7	Communities (aquatic; use of Ambient Water Quality Criteria)	Acute and chronic effects
8	Deltas (restoration of)	Acute and chronic effects
9	Ecosystems (aquatic, rare, and terrestrial)	Acute and chronic effects
10	Endangered and threatened species (also their habitats and populations)	Acute effects; secondary toxicity; cumulative, reproductive, or chronic effects; effects on habitat or food supply
11	Environments (terrestrial and aquatic)	"Potential for significant environmental degradation"; "severity, duration, or geographic scope of impacts"; "violation of a national environmental standard"
12	Estuaries	Chronic effects; toxic sediment accumulation; reduction of pollutant loadings to estuary
13	Fish (health of commercial fishery populations; sportfish; juvenile salmonids and other anadromous fish)	Acute and chronic effects; sublethal effects; adverse water temperature and flow; adverse hydrologic conditions; expected exceedance of an aquatic "concentration of concern"
14	Food chain/food web (aquatic and terrestrial)	Acute and chronic effects; bioaccumulation
15	Habitats (more specific references to breeding areas for large or dense aggregations of terrestrial animals; migratory bird flyways, critical spawning/feeding areas [e.g., juvenile salmon nurseries, eel grass beds]; intertidal, subtidal, and upland areas)	Acute and chronic effects; sublethal effects; loss of habitat; land development; expected exceedance of an aquatic "concentration of concern"
16	Habitats (general references to natural, rare, remote, sensitive, special, or unique aquatic and terrestrial habitats)	Acute and chronic effects; sublethal effects; loss of habitat; land development; expected exceedance of an aquatic "concentration of concern"
17	Invertebrates (aquatic; daphnia)	Acute and chronic effects; sublethal effects
18	Life (aquatic)	Acute and chronic effects
19	Mammals (terrestrial)	Not specified
20	Marine sanctuaries	Not specified
21	Mollusks (aquatic; nontarget and commercial)	Acute and chronic effects
22	National and State Wildlife Refuges	Not specified
23	National Estuaries	Not specified
24	National Forests	Acute and chronic effects
25	National Parks	Not specified
26	Native species (terrestrial)	Replacement by invasive species; brown-headed cowbird
27	Populations (balanced indigenous)	Acute and chronic effects
28	Resources (natural, sensitive, terrestrial, and aquatic)	Acute and chronic effects; adverse effects in general; "threats to national environmental resources . . ."

Table 2-1. Examples of Ecological Concerns Used in EPA Decisions (continued)

#	Valued Ecological System or Component	Concern(s)
29	Riparian habitat (aquatic and terrestrial aspects of)	Acute effects; loss of riparian areas
30	Species (aquatic and terrestrial; commercially important)	Acute and chronic effects; effects in general
31	Vegetation (agricultural crops, aquatic plants [e.g., deep pendent grass, a food source for waterfowl]; terrestrial plants not targeted for pesticide control; sensitive plants)	Acute and chronic effects; potential damage; phytotoxicity; water channel characteristics
32	Water (e.g., rivers, sloughs and streams, surface water, open water)	Acute and chronic effects; avoid/offset adverse impacts of dredging, flood control, development, etc.; reduce level of toxic substances in the Great Lakes and surrounding habitat; potential damage
33	Water quality	Acute and chronic effects; potential impacts; water chemistry; use of water quality standards
34	Water supply (quantity)	Chronic effects; potential impacts
35	Wetlands (variety, functions, organisms, and values; increase, maintain, protect, and restore)	Acute and chronic effects; loss of wetlands, acreage, unique or scarce types; adverse hydrologic impacts; potential impacts
36	Wild and Scenic Rivers (designated by state and federal legislatures)	Not specified
37	Wilderness Areas (i.e., Congressionally protected areas within National Forests)	Not specified
38	Wildlife (terrestrial and aquatic; endangered wildlife; use of no observed adverse effect levels [NOAELs] and lowest observed adverse effect levels [LOAELs])	Not specified

endangered species, and biological diversity (e.g., the two Environmental Law Institute reports cited in the References section).

EPA's statutes do not generally contain operational definitions for assessment endpoints (step two of Suter's [1989] definition); therefore, operational definitions, too, are left to interpretation by EPA. Little effort has gone toward this critical step in defining assessment endpoints; yet without operational definitions to provide direction for testing and modeling, the results of risk assessment tend to be ambiguous (Suter, 1989). Some operational definitions for ecological concerns do exist at EPA, but they tend to focus more on whether increases or decreases occur in toxicological rather than ecological parameters. Although most of the ecological concerns identified in this study are not defined in operational terms, they can be used by risk managers and assessors as a starting point to define assessment endpoints useful for ecological risk assessments (as well as for broader ecosystem management and nonregulatory efforts under way at EPA).

2.2 Range of Ecological Concerns Used in Agency Decisions

The tables and survey summaries found in Appendices D and E were used to draw more detailed conclusions about ecological concerns used in past EPA decisions. Overall, EPA program decision-makers have used a

variety of ecological concerns, but the survey shows an emphasis on animals (particularly aquatic species), acute mortality, and chemical stressors. It is interesting to note that several concerns clearly imply direct benefits to humans (e.g., commercial fisheries and wetlands), and some have statutory authorities that justify their protection or managed use (e.g., animals listed under the Endangered Species Act and public lands). The following sections summarize some of the more important and obvious findings of this analysis.

2.2.1 Acute, Chronic, and Sublethal Effects

The term "acute and chronic effects" in Tables 2-1, D-1, and D-7 almost always refer to the use of information from single-species laboratory toxicity tests. Acute tests generally measure mortality over a short period, while chronic tests measure mortality as well as sublethal effects on growth and reproduction over a longer period. Overall, acute mortality appears to be the most frequently and widely used ecological effect of concern at EPA. Perhaps one reason is that regulatory determinations of cause and effect are generally easier to substantiate when there is obvious acute stress and associated mortality. Chemical spills and resultant fish or bird kills are also more easily communicated to and recognized as an immediate concern by the public, which influences government action.

Another possible reason for the emphasis on acute mortality is the preponderance of laboratory toxicity test results on acute mortality. Available laboratory toxicity data appear to heavily influence what is of ecological concern at EPA. For example, acute mortality to birds and fish is important in several programs because LD₅₀ and LC₅₀ test results are available to predict these effects (e.g., LC₅₀s on daphnia and rainbow trout, and LD₅₀s on earthworms, shrews, mallards, starlings and bobwhite quail). In only a few cases was regulatory action taken solely based on long-term effects to habitats or sublethal effects to wildlife. No cases were found where regulatory action was based on sublethal effects to plants.

2.2.2 Chemical, Biological, and Physical Stressors

As expected, all program areas consider chemical stressors and impacts. Concerns about biological stressors tend to focus on exotic or non-native species (e.g., invasions of zebra mussels and brown-headed cowbirds). Many of the physical stressors identified (e.g., habitat loss and hydrologic changes) are considered within the context of various permitting sections of the Clean Water Act that protect coastal, riparian, and wetland areas through the use of existing regulations on dredge-and-fill activities in navigable waters of the United States. Physical stressors also have been considered by the National Environmental Policy Act (NEPA) program (in review of large federal projects such as the construction of highways, bridges, and dams). Table D-3 in Appendix D summarizes the types of stressors considered by EPA programs.

2.2.3 Types of Organisms Assessed

This survey found that EPA tends to give more consideration to animals (i.e., birds, fish, mammals) than plants (i.e., native flowers, shrubs, trees). Protection for some animals, however, such as amphibians and reptiles, commonly has been neglected. Table D-5 in Appendix D provides additional detail about the types of organisms that EPA programs assess.

2.2.4 Concerns at Various Levels of Biological Organization

The four findings below focus on survey results with respect to Agency considerations at various levels of biological organization: groups of individuals, populations, multiple species, and habitats/ecosystems (see also Table D-2 in Appendix D).

2.2.4.1 Individuals

This survey indicates that EPA does emphasize concerns about groups of individuals, such as the total

number of fish killed by a chemical stressor. Less emphasis and consideration is given to the number of individuals of a particular species, or the number of species (range of taxonomies) adversely affected by anthropogenic stressors. Aside from endangered species, the Agency does not appear to have regulated against any adverse effects occurring to an individual nonhuman organism. No quantitative threshold exists at EPA for an unreasonable or intolerable number of adversely affected nonhuman organisms (i.e., something akin to the 1×10^{-6} cancer risk for human health).

2.2.4.2 Populations

When nonhuman populations are considered in an assessment, EPA typically mentions existing information about the decline or extinction of a local population at a specific site, and describes whether the stressor in question may or may not be a potential concern. EPA does not typically consider dynamic population parameters such as birth, death, emigration, and immigration rates. Apparently this is partly because the availability of population data is limited, and because efforts required to characterize causal and temporal trends between environmental stressors and populations are complex, expensive, and time-consuming. Some programs may assess population changes through inference from laboratory toxicity tests on mortality, growth, and reproduction.

2.2.4.3 Multiple Species

Some program areas consider the effects of stressors on multiple species. Perhaps the best example of multiple species concerns at EPA is the use of Ambient Water Quality Criteria (AWQC). The use of AWQC implies a concern for the protection of more than one aquatic species (U.S. EPA, 1988b). However, EPA does not typically consider *interactions* among different species (such as predator-prey relationships), a critical aspect of determining the nature and range of actual or potential impacts throughout a community of living organisms. A widespread assumption exists at EPA that protecting individual species will protect a community; however, the validity of this assumption is still a subject of scientific debate.

2.2.4.4 Habitats and Ecosystems

EPA appears to emphasize the protection of wetlands, estuaries, and large geographic areas such as the Chesapeake Bay, the Great Lakes, and San Francisco Bay. Generally, however, the Agency does not evaluate stressors within the context of interactions occurring among animal and plant communities and their abiotic environment (the classic definition of an ecosystem).

Chapter 3

Comments Received on Improving Ecological Considerations at EPA: Perspectives on Regional and Headquarters Needs

3.1 Overview

Most of the program areas interviewed (22 in the Regions and 16 in Headquarters) provided comments for improving considerations of ecological risk at EPA. Responses came mainly from the questions asked under the “Management and Guidance Issues” section of the informal survey (see Appendix B).

After reviewing all the comments, general categories of needs for improving ecological risk decisions at EPA began to emerge. These general needs, in descending order of the number of times encountered, include the following:

- Policy guidance (i.e., management direction for ecological protection).
- Technical guidance and support (e.g., the need for ecological risk assessment tools, methods, approaches).
- Ecological expertise (e.g., the need for more ecologists and ecological training).
- Access to quality information and data (e.g., information on stressors adversely affecting important ecological resources).
- Changing Agency culture or tradition (i.e., expanding programs beyond EPA's predominant focus on protecting human health).
- Defining EPA's authorities and roles for ecological protection (e.g., reinterpreting EPA's statutory authorities, defining the respective ecosystem protection roles of EPA and other public- and private-sector partners).
- Fiscal resources.

Figure 3-1 shows the relative frequency with which these needs were expressed by Regional and Headquarters programs. This figure does not represent a statistical analysis; many of the categories are not mutually exclusive. (See Appendix A for additional information about survey methods.)

In the Regions, most of the program areas interviewed state that policy guidance for ecological risk assessment

is the most important need. A majority of the Headquarters programs agree. More Headquarters than Regional programs, however, state that providing technical guidance and support and access to quality information and data are more important. Half the Regional programs state that technical guidance and support and more ecological personnel and training are the next most important needs, followed by access to quality information and data. From a Headquarters perspective, additional ecological personnel and training are also a major concern (mentioned by well over half the program areas interviewed).

Other important but less common responses included the need to address cultural influences that limit ecological considerations within EPA (mentioned by over one-third of the program areas in both the Regions and Headquarters). Some program areas expressed concerns about whether EPA has a clear role or statutory authority for protecting ecological resources (an issue that appeared to be more important to the Regions than Headquarters). Limited monetary resources were a concern to only five Headquarters and two Regional program areas.

3.2 Issues and Suggestions for Improving Ecological Considerations at EPA

The following subsections highlight some of the more common issues and suggestions that Regional and Headquarters staff raised for improving ecological considerations at EPA. Issues and suggestions for improvement are discussed under the following headings: policy guidance, technical guidance and support, ecological expertise, information and data, Agency culture, and authorities and roles. Additional comments are provided in Appendix E.

3.2.1 Policy Guidance

Over three-fourths of the programs interviewed support the need for ecological policy guidance within EPA. Most agree that clear policy statements are necessary for effective ecological risk assessments, but few

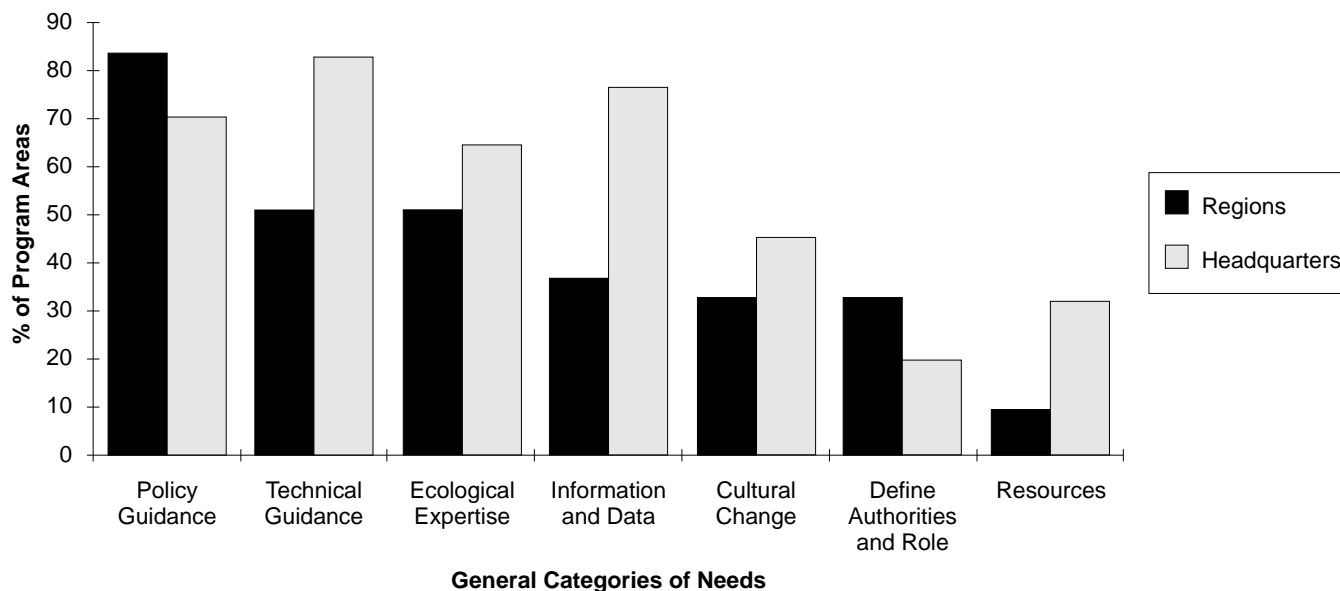


Figure 3-1. Regional and Headquarters perspectives on improving considerations of ecological risk at EPA.

unambiguous assessment endpoints (i.e., ecological values to protect) exist at EPA. Many feel that existing policies, such as avoiding “widespread and repeated kills” or achieving “no net loss of wetlands,” require further definition to be useful as guidance. For example, risk assessors typically like to know how many chemical spills, miles of impacted stream, or fish mortalities are required to meet the “widespread and repeated kill” policy. As aptly summarized by one Headquarters program, the result of not articulating clear assessment endpoints or ecological concerns is that all types of data are compiled and reviewed with no sense of what constitutes “sufficient data” for a decision.

Many of those interviewed in this survey seek guidance on the relative value that EPA should place on different types of ecosystems or ecosystem components (e.g., old-growth forests versus timber forests, domestic or commercial species versus wild species, native versus non-native [exotic] species, game versus nongame species, and natural resources such as ground water and minerals versus biological resources such as living organisms). Others want guidance on whether they should focus on chemical, physical, and/or biological stressors. They also want guidance on whether to focus on protection of individuals, populations, communities, and/or entire ecosystems or landscapes (e.g., Should programs focus on reducing risks to individual birds, populations of birds, and/or habitats of birds?). Many also seek guidance on how to make tradeoffs between ecological risks versus human health or human welfare risks.

Many individuals suggest establishing definitions or checklists of important ecological resources to protect. One individual suggested developing a listing of previous EPA decisions (based on ecological concerns)

that can be referenced when setting or enforcing ecological protection requirements for the regulated community. Another suggested that EPA play more of a role in assisting the public and private sector to make ecologically and economically sound decisions regarding tradeoffs (e.g., timber harvests versus old-growth forests). One individual suggested that natural resource trustees (e.g., the Bureau of Land Management, Forest Service, National Park Service, Fish and Wildlife Service), not EPA, should define the ecological values that should be protected. [Authors’ note: The Superfund program has experience in working with natural resource trustees in selecting endpoints for risk assessment.]

3.2.2 Technical Guidance and Support

Well over half of the Headquarters and Regional programs interviewed stress the need for technical guidance or support for conducting ecological risk assessments. Several programs interviewed were either unaware or vaguely familiar with Agency-wide guidance on ecological risk assessment (i.e., the *Framework for Ecological Risk Assessment* [U.S. EPA, 1992]). Many individuals favor more tailored or step-by-step guidance, or case studies on how to apply the *Framework* or other ecological risk approaches or techniques to their specific activities. To a certain extent, such guidance is already being provided by the Risk Assessment Forum (see U.S. EPA, 1993e). One program area states that available ecological guidance is too complex for managers and yet too simple (or of little use) for trained ecologists. Another states that Regional comparative risk assessments are “too anecdotal.”

Many suggestions were made for improving the way EPA technically assesses ecological risk. For example,

one program area recommends that the entire Agency needs to use more of an ecosystem-level approach and to embrace concepts not traditionally emphasized such as island biogeography, fragmentation, landscape ecology, and cumulative impacts. Another program area suggests that EPA use an iterative approach to ecological risk assessment (i.e., EPA should initially scope out a particular area of interest to determine, for example, whether any endangered species and sensitive habitats are present and, if so, to identify any additional data that are needed to reach a decision on assessing these or other valued ecological resources). Others suggest that standard protocols be developed for assessing the general environmental values of a site. For example, the U.S. Fish and Wildlife Service's Habitat Evaluation Procedure (a technical, quantitative method) could be used to determine the value of a particular habitat for a particular organism. Some individuals also recommend that technical guidance be short like Superfund's ECO-Update Newsletter series, not long like the Risk Assessment Forum's *Framework for Ecological Risk Assessment*, and they state that EPA may need to establish technical rules among the Regions on how to assess ecological risks. [Authors' note: It is unclear whether or not the recommendation to establish technical rules entailed establishing a minimum technical standard among the Regions.]

3.2.3 Ecological Expertise

Over half the programs interviewed urge EPA to acquire more ecological expertise and training. In particular, several individuals recommend that EPA hire more terrestrial (e.g., forest and wildlife) biologists or ecologists. One Regional program area emphasizes that field biologists are needed. These comments agree with the authors' previously held notions that in some Regions and programs, there are few trained ecologists, and that a disproportionate number have training in aquatic rather than terrestrial systems.

Many individuals would like more ecological training. There are those with limited backgrounds in the biological sciences (e.g., program managers) who would benefit from some "basic training" in ecological principles, and others, such as biologists and environmental scientists, who seek additional training on how to apply ecological risk principles and methods in Agency risk assessments. Many offices say that they are limited in the range and volume of ecological activities they can conduct due to a lack of staff with ecological expertise or a lack of access to other sources of ecological support (expertise in other EPA program areas or contractors). In the Regions, some individuals say that they lack a mechanism and funding to access appropriate expertise. Others feel that there is too much reliance on outside contractors, and that, in many cases, contrac-

tors also lack ecological expertise or do not perform ecological assessments adequately.

3.2.4 Information and Data

Over half the programs interviewed state that ecological risk management decisions are limited by a lack of ecological data. More Headquarters programs, however, mentioned this issue than Regional programs. (This is perhaps because the Regions are more likely to be aware of local information and data sources than personnel stationed in Washington, DC.)

Many issues exist regarding the use or lack of information within EPA. Two program areas mention that at the management level, inconsistencies often occur regarding the amounts and types of ecological data necessary for making decisions. Others report that they have limited access to ecological information or must depend on other federal agencies for information used in making EPA decisions. Others state that some types of ecological information collected by or for EPA lack quality assurance/quality control, have a high level of uncertainty associated with them, or are difficult to interpret (i.e., data come in different forms, so analyzing it is like comparing "apples and oranges"). Several individuals state that few ecological risk criteria are available (i.e., quantitative regulatory "benchmarks" or thresholds of concern such as AWQC).

Individuals suggest that more information-sharing between EPA and the states should take place (e.g., sharing risk assessment results and plans for protecting endangered species), and that management should support the attainment and use of up-to-date, "real life" data for assessments and decisions (e.g., ecological incident data and information on chemical use by businesses and the public).

3.2.5 Agency Culture

Over one-third of both the Headquarters and Regional programs assert that office or Agency culture limits ecological considerations at EPA. As one individual notes, a lack of management interest can severely limit ecological protection activities. Although it is difficult to say how much management resistance or acceptance exists for incorporating ecological concerns at EPA, it is evident from many of those interviewed that program managers often find themselves in unfamiliar territory when it comes to decisions involving ecological protection.

Several Regional and Headquarters program areas state that ecological concerns are of low priority because of EPA's long tradition of human health protection. According to them, this legacy still predominates in most office cultures today and limits efforts to establish ecological levels of concern, implement existing ecological standards throughout EPA (e.g., AWQC), and plan for

improving considerations of ecological risk in the future. Overall, office attitudes about incorporating ecological concerns in decisions ranged from “There is no need to address ecological concerns” to “[The program area] focuses on aquatic concerns” (a common, but limited, concern within the broader context of ecological protection).

Some Regional program areas state that ecological risk management opportunities are limited to some extent because ultimate decisions are made by Headquarters. One program area states that “unwritten instructions” from Headquarters direct that decisions at the Regional level can be partially, but not solely, based on ecological risks. One Regional individual feels that accountability measures of “effectiveness” tend to be more administrative than environmental; for example, there tends to be a greater focus on the number of permits issued than on accountability measures showing whether the environmental quality of aquatic or terrestrial habitats is actually improving.

3.2.6 Authorities and Roles

More Regional than Headquarters program areas state that EPA needs to define its role in protecting ecological resources. Several individuals recommend that EPA clearly define its role in ecological protection in relation to other federal agencies (e.g., public land management agencies in the Departments of Interior, Agriculture, Commerce, and Defense). One Regional individual

suggests that EPA's focus is currently too narrow and that the Agency should strive to attain a broader federal role in environmental protection. Other EPA staff, however, state that previous relationships between EPA and natural resource trustees have not been trouble-free. Problems have occurred because of overlapping jurisdictions (e.g., controversies over who has the lead or who makes the final call on a particular issue) or because of fragmented, uncoordinated activities.

One individual states that a clear Agency role is necessary for effective risk assessment. One Regional program suggests that precedents for EPA's evolving role could be established sooner if a catalog of ecological decisions was developed to assist programs in working with public and private institutions outside EPA, and if the techniques for success in EPA's ecological protection efforts could also be recorded and emphasized for use in other EPA activities (e.g., create an informal electronic bulletin board). Activities like this could assist programs such as one Regional program area surveyed that believes it has no statutory authority to take regulatory action based on ecological concerns.

3.2.7 Fiscal Resources

A few program areas interviewed state that insufficient budgets or funding reductions limit ecological considerations at EPA. One Headquarters group asserts that some Regions do not want to incur the extra costs of ecological assessment.

Chapter 4

Recommendations: Next Steps To Consider

During the development of this report, a number of key recommendations emerged for improving ecological considerations in program decisions. The following recommendations represent the authors' analysis and interpretation of the survey responses from EPA Regional and Headquarters programs. The recommendations are offered as a point of departure for future discussions among EPA managers and staff, as well as external parties, to define in more specific terms what EPA should strive to protect or manage from an ecological perspective.

1. Ensure an appropriate balance between ecological, human welfare, and human health concerns in Agency regulations and policy.
2. Develop common Agency-wide ecological protection concerns.
3. Encourage an open process for developing ecological concerns and assessment endpoints.
4. Specify rationales and establish precedents for ecological protection.
5. Set up formal processes to ensure that risk managers and assessors interact effectively in ecological risk assessments.
6. Develop ecological risk management guidance and training, and recruit additional staff with ecological expertise.
7. Improve ecological risk communication.
8. Explore, develop, and apply new scientific tools for ecological risk assessment and new economic tools for ecological risk management.

Each of these recommendations is discussed in more detail below.

4.1 Ensure an Appropriate Balance Between Ecological, Human Welfare, and Human Health Concerns in Agency Regulations and Policy

There remains within EPA an artificial conceptual division between ecological and human concerns and a strong legacy of emphasizing human health protection,

despite the fact that human health and welfare are inextricably linked to and dependent on the long-term health of ecosystems (U.S. EPA, 1990a, b). As discussed in Chapter 1, the SAB has recommended that EPA set Agency risk-based priorities with an appropriate balance between ecological, human health, and human welfare concerns. The Agency's new Tiering Process for Regulatory and Policy Development, where priorities for regulation, policy development, and cross-media interaction are determined, is one good example of where the Agency could strive to achieve this balance.

Throughout this process, program offices should keep in mind that one of EPA's primary roles in protecting ecological systems and components (and their benefits to human health and welfare) is to regulate pollution (a form of habitat degradation and stress to native plant and animal species). For example, EPA can regulate air and water pollutants, pesticides, toxics, and wastes that harm ecosystems. EPA can also prevent physical habitat destruction in its decisions about dredge-and-fill activities, federal projects, and the siting of various treatment facilities.

4.2 Develop Common Agency-Wide Ecological Protection Concerns

At present, the public and EPA's partners in environmental protection (e.g., federal and state land management and environmental quality agencies) are unaware of EPA's specific ecological protection concerns. Within EPA, ecological decision-making is not guided by an agreed-upon set of specific ecological protection concerns, particularly concerns pertaining to the entire Agency (e.g., cross-cutting values or concerns). Many of the ecological concerns identified by this report pertain only to one Regional or Headquarters program office, require further clarification (i.e., are not readily applicable for use in risk assessments or management decisions), or are used in an inconsistent or ad hoc manner.

EPA needs to establish an initial set of ecological concerns (i.e., descriptive principles or objectives, not necessarily numerical standards) that will be considered in all Agency activities, such as the development of ecological risk assessments, regulations, and policies.

(Arrow 1 in Figure 4-1 shows where such principles or objectives could benefit ecological risk assessments.) For example, EPA has made the protection of endangered and threatened species an Agency-wide concern (U.S. EPA, 1993d, 1994b,c). Examples of other potential Agency-wide concerns include reducing risks to migratory birds; wetlands; commercial fisheries; Congressionally designated Wilderness Areas and Wild and Scenic Rivers; public lands such as National Parks, Wildlife Refuges, Forests, Grasslands, and Estuaries; and important privately owned lands such as Nature Conservancy Preserves and National Audubon Society Sanctuaries.

Once Agency-wide concerns are known and a baseline is established, EPA program areas can define these concerns in more specific or operational terms to suit their needs (e.g., as assessment endpoints useful for ecological risk assessment). Other ecosystem management and nonregulatory initiatives at EPA can also make use of these Agency-wide concerns. Not everyone will agree with EPA's initial set of Agency-wide concerns, but scientific and policy advancements in EPA's ecological protection efforts cannot occur unless everyone knows what the ecological concerns underlying EPA's decisions really are.

A workgroup process should occur to determine selection criteria for developing the initial set of Agency-wide ecological concerns (e.g., Is the ecological system or component amenable to economic analysis? Is it protected by statute? Does it require legislation or rulemaking to provide it with legal protection?). Once selection criteria are established, a list of proposed ecological protection concerns can be developed, with input from both internal and external sources, and forwarded to EPA's senior management for final resolution. When ecological concerns have been established, EPA should develop a strategic plan describing specific actions, timelines, and budget and staffing needs to foster and guide the application of these Agency-wide ecological concerns in the program areas. A process for periodically reviewing and amending these Agency-wide concerns should also be considered.

4.3 Encourage an Open Process for Developing Ecological Concerns and Assessment Endpoints

Selecting ecological concerns and assessment endpoints of interest to EPA has traditionally been a closed process within the Agency. Congress, the courts, the media, and interest groups have played an influencing but outside role in these internal decisions. In some programs, however, ecological concerns and assess-

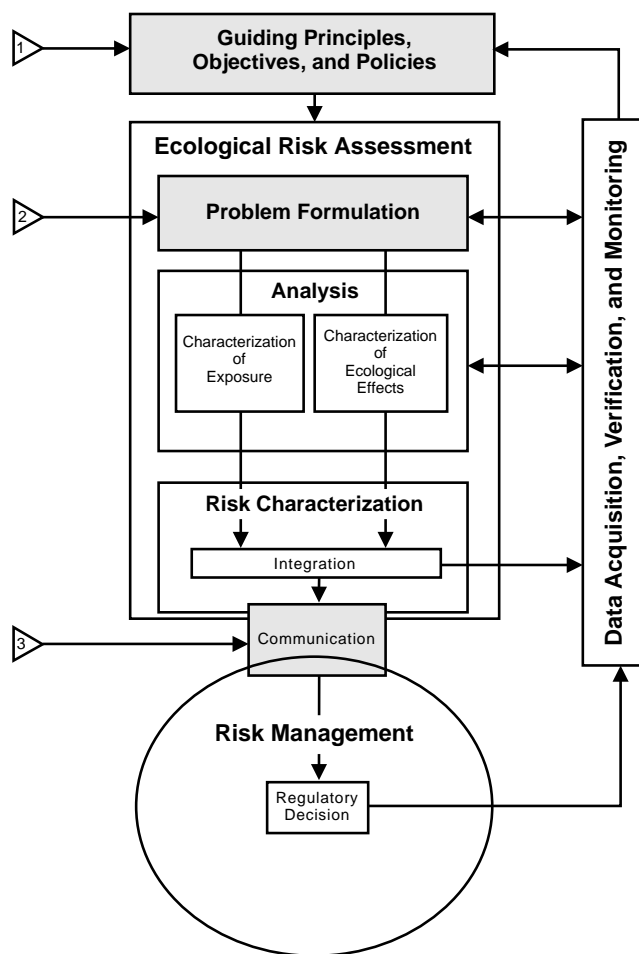


Figure 4.1. Important areas of interaction between risk managers and risk assessors in ecological risk assessment (modified from U.S. EPA, 1992a).

ment endpoints are now being selected in a more open process in which groups outside EPA are approached in the beginning stages of a project to identify objectives for ecological protection.

Such a process has occurred, for example, in the Superfund program, which recognizes that ecological concerns at listed hazardous waste sites (e.g., migratory waterfowl, wetlands, anadromous fish) frequently are of interest to trustees of natural resources such as federal, state, or tribal entities. Other examples include the "Watershed Protection Approach" being developed within the Office of Water and EPA's National Goals Project. In the Watershed Protection Approach, stakeholders (i.e., people or institutions most likely to be concerned or most able to take action within a watershed) are involved in identifying primary concerns about threats to human and ecosystem health or goals for ecological protection (U.S. EPA, 1993f). In EPA's National Goals Project,

stakeholders (i.e., the public) are being asked to comment on thirteen proposed goals for the Agency, one of which is ecological protection (U.S. EPA, 1994d). These more open processes appear to have the effect of both promoting cross-media efforts within the Agency and developing public support for reducing ecological risks.

EPA should consider an open process, consisting of two parts, for developing Agency-wide ecological concerns or assessment endpoints useful for ecological risk assessment. First, EPA should enlist a spectrum of experts for an open discussion of the scientific and technical issues involved. Once the scientific issues have been aired, a broader public discussion should take place, focusing on the wider social issues associated with establishing consistent ecological concerns and endpoints (i.e., establishing what is important to protect from a societal viewpoint).

4.4 Specify Rationales and Establish Precedents for Ecological Protection

Compared with human health concerns, the Agency has less precedent for protecting ecological resources. Therefore, EPA should consider documenting its ecological decisions, including the rationales for those decisions, in an ongoing way. Where the Agency finds strong scientific and societal justification for a decision, it can consider using that decision as a precedent for similar decisions in the future. EPA should not, however, be constrained by past precedents in developing sound approaches to ecological decision-making.

EPA should also consider making information about ecological protection decisions available to EPA staff and the public. An ecological risk management decision database would allow EPA staff to share and develop risk management information useful to all the media programs, promote the use of consistent ecological assessment endpoints, and facilitate cross-program risk assessments. Information contained in the database could include the following:

- Description of decision by program area and type of decision (e.g., Superfund/Record of Decision).
- Date of decision.
- Documentation or reference.
- Contact person.
- Assessment endpoints (as defined by the *Framework* and by Suter [1989]).
- Measurement endpoints (as defined by the *Framework*).
- Stressors (as defined by the *Framework*).

- Geographic location.
- Economic costs associated with ecological protection (e.g., regulatory impact analyses and other referenced analyses).

4.5 Set Up Formal Processes To Ensure That Risk Managers and Assessors Interact Effectively in Ecological Risk Assessments

Risk assessors cannot be expected to determine society's ecological concerns in isolation. EPA's risk managers, responsible for interpreting what is and is not in the public interest, must be involved as well. Specifically, vital interactions between risk managers and risk assessors need to occur at several times during the ecological risk assessment process, including the "problem formulation" and "discussion of results" phases (see arrows 2 and 3, respectively, in Figure 4-1). Problem formulation is:

... the first phase of ecological risk assessment and establishes the goals, breadth, and focus of the assessment. [E]stablishing a two-way dialogue between risk assessors and risk managers during the problem formulation phase [is] a constructive means of achieving both scientific and societal goals ... risk managers charged with protecting societal values can ensure that the risk assessment will provide relevant information to making decisions, ... [and by] bringing scientific knowledge to the discussion the ecological risk assessor ensures that the assessment addresses all important ecological concerns. Both perspectives are necessary to appropriately utilize resources to produce scientifically sound risk assessments that are relevant to management decisions and public concerns (U.S. EPA, 1992a).

Problem formulation can benefit from involvement by the public and is the phase where operational assessment endpoints are defined (see Sections 2.1 and 4.3).

The "Discussion of Results" phase is where the results of the ecological risk assessment serve as input (along with other requirements defined in EPA's statutory authorities) to identify and evaluate optional risk management decisions. The purpose of this discussion "is to ensure that the results of the risk assessment are clearly and fully presented and to provide an opportunity for the risk manager to ask for any necessary clarification" (U.S. EPA, 1992a).

EPA should consider requiring that the results of "problem formulation" and "discussion of results" meetings be described in new risk assessment/rulemaking packages. In addition, an in-house facilitator or a designated office could be established to offer third-party assistance during these discussions.

4.6 Develop Ecological Risk Management Guidance and Training, and Recruit Additional Staff With Ecological Expertise

Many ecological risk assessments being performed in the Agency do not provide optimum information for making risk management decisions. Guidance and training are needed to overcome this problem and build a successful dialogue between risk managers and assessors. Some EPA programs are developing training that will help to meet some of these needs. For example, the Office of Policy, Planning, and Evaluation (OPPE) is developing an ecological risk and decision-making workshop that addresses risk management as well as assessment. The Superfund program has developed a technical course relevant to hazardous waste ecological assessments.

In addition to providing guidance and training for ecological risk management and risk assessment, the Agency should also consider recruiting additional ecologists, biologists, and ecotoxicologists. These scientists would strengthen the Agency's base of ecological expertise, thereby helping to ensure scientifically sound ecological decision-making.

4.7 Improve Ecological Risk Communication

Another key Agency need is better communication within and outside EPA about ecological risks and decisions. Very few people at EPA have combined qualifications or training in both ecology and public affairs (e.g., communication, outreach, or facilitation). Combine this with the lack of a specific message about EPA's ecological concerns and the result is simply poor communication. Training, recruitment, and project planning need to occur to improve EPA's communication of ecological risk information to Agency decision-makers and the outside world.

4.8 Explore, Develop, and Apply New Scientific Tools for Ecological Risk Assessment and Economic Tools for Ecological Risk Management

4.8.1 Scientific Tools

Program managers should help plan for the next generation of technological advances in risk assessment and not remain forever bound by existing methods and data. Program offices need to clearly express and plan for improvement of their ecological risk decisions. They should specify the particular ecological effects, stressors, or routes of exposure that are of interest to them, and should generate ideas for potential regulatory applications for emerging scientific methods, techniques, in-

formation, and data sets. EPA scientists within the program areas and the Office of Research and Development also should be continually challenged to develop and improve the scientific tools needed to assess ecological risks.

Many scientific advancements already exist that, for various reasons, are not applied in Agency decisions. Examples include population and ecosystem models that can project the number of individuals of a species present in a given area over time, and models that can predict the succession of habitat types across a watershed over time. These models, when used with appropriate data, can produce more meaningful results than the "risk quotients" that EPA is accustomed to using (i.e., ratios of predicted environmental concentrations versus reference concentrations known to be lethal or otherwise toxic to various laboratory species). The results of such models can be useful for implementing a policy of ecosystem management and protection. In addition, compared with risk quotients, model results can be easier to explain to the public and typically produce better information for economic analyses. In certain situations (e.g., in regulatory decision-making), limited resources, information, or time might preclude the use of such models, but EPA should consider making greater use of them in ecological risk assessment when such use is practical and scientifically justified.

Geographic applications for visualizing and addressing environmental problems (e.g., combining chemical, physical, and biological data in a spatial way) are also of keen interest. This interest is due in part to the development of new technology (e.g., geographic information systems) and the emerging emphasis on moving "from programs to places" (i.e., bringing EPA's programs together in an integrated fashion to protect specific places with valued ecosystems or natural resources). Some also feel that EPA should seek the authority to set standards on a geographic basis (e.g., establish a more stringent NO_x standard for the Chesapeake Bay estuary without affecting the national standard set for the rest of the country). Several EPA programs are developing expertise in the use of geographic information systems, but need technical and policy guidance to make these and other geographic applications more useful for ecosystem management decisions.

Interesting technical suggestions provided by program areas in this survey were to continue support for the ECOTOX database and to consider the next step of setting up a process of deriving Agency-wide ecological reference doses or concentrations modeled after EPA's Integrated Risk Information System (IRIS). The end result could be an "ECO-IRIS," which would save time and resources by providing scientifically credible, consensus-based, quantitative toxicity benchmarks for use in ecological risk assessments.

4.8.2 *Economic Tools*

Many of EPA's risk decisions require some form of balancing between risk reduction and economic costs. Therefore, it can be important in some programs to place monetary values on damages to ecological resources. When this is the case, it is important to plan for the economic analyses while designing the ecological risk assessment.

Thus, risk assessors and managers should work with economists to include assessment endpoints that will also be useful for the valuation of ecological resources. This will facilitate the use of established methodologies, such as contingent valuation, for considering ecological resources in economic terms. Program managers should also support activities that lead to better economic methods of valuating ecological services that benefit human health and welfare.

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Appendix A

Methods

Most of the information in this report is from a series of interviews conducted between August 1992 and March 1993 with staff representing over 40 different EPA Headquarters and Regional program areas thought to consider ecological risks in their activities (see Appendix C). Appendix C also contains the EPA program office abbreviations used in the tables throughout this report. The interviews are based on a standard set of questions found in Appendix B. A summary of each interview is found in Appendix F. Each summary describes specific decisions made by the program offices and the statutory and regulatory authorities upon which they are based. The summary also includes a more in-depth description of ecological concerns, along with references to the source information.

During all interviews, each question was asked and answered in written order. The interview participants were selected by the program managers and/or authors based on their knowledge of particular programs and staff activities. The interviews covered most of the major program offices at EPA Headquarters that have considered ecological issues at some point in their history. Interviews were also carried out in four of EPA's Regional offices: Philadelphia (Region 3), Chicago (Region 5), San Francisco (Region 9), and Seattle (Region 10). The four regions selected provided an extensive geographic range, as well as a range of experience in dealing with ecological concerns. Some EPA programs, Superfund being a good example, were very decentralized in their analysis and decision-making, and the authors lacked the time and resources to survey all ten regional offices. Other programs, however, were found to be very centralized in their analysis and decision-making (e.g., the pesticides program), and thus relatively few regional interviews were required to satisfy the information needs for this report.

As part of the documentation process, written materials were requested to support statements made during the interviews. This may have included Federal Register notices, records of decision, policy documents, program guidance, or even internal memoranda. Of particular interest were ecological concerns used as the basis of an Agency decision or action. No attempt was made to inventory nor quantitatively assess every decision ever

made by EPA on the basis of ecological concerns. A completely exhaustive inventory of this type is, for all practical purposes, impossible to do because no readily accessible repositories of such information exist. Recent decisions during and after the course of the survey may have been missed and not included in this report. The use of a uniformly applied process of interviews and followup activities, however, allowed as many examples of ecologically based decisions as possible to be identified and collected, given the time and resource constraints for this report. It is also important to note that information was not collected for the purpose of judging the technical adequacy of any ecological assessments.

Brief written summaries of each interview were prepared based on written notes and all documents collected. Each summary includes a general description of the Regional or Headquarters program decision area, the ecological concerns used, and any quantitative, regulatory levels of ecological concern. Each individual was given the opportunity to review and comment on the interview summary before it appeared in this report.

Responses to survey questions about office needs and suggestions for improving considerations of ecological risk were also compiled and are presented in Chapter 3 of this report. During the initial review of these comments, general categories of needs for improving ecological risk decisions at EPA began to emerge. These categories are found in Figure 3-1 and discussed in detail in Chapter 3. After the initial review, all the comments were analyzed again to count the number of Headquarters and Regional offices that made comments falling into the general categories. Normalized Regional and Headquarters percentages for each general category were calculated based on the 22 Regional and 16 Headquarters programs commenting. The results in Figure 3-1 are all based on this procedure to provide the reader with more of an Agency-wide perspective of these issues. The results describe the percentage of program areas with similar categories of needs. In particular, one can see the relative importance of a given category to Headquarters and Regional program areas, and then compare the relative importance of different categories to both Headquarters and Regions.

Appendix B

Interview Questions

Management Guidance for Ecological Risk Assessment: A Survey

We are interested in identifying program decisions that include ecological information. *We are particularly interested in identifying any ecological values or concerns that drive Agency decisions or actions.* Several of the risk terms used here are defined at the end of the survey and are from the recently published *Framework for Ecological Risk Assessment*.

A. Identification of Ecological Decisions/Background Information

1. Summarize the regulatory, strategic planning, and other internal program decisions made by your office that incorporate ecological information.
2. Please indicate the specific sections of statutory and regulatory authorities that pertain to these decisions.
3. At what level of management are these decisions finally made (e.g., AA, RA, Office Director, Division Director, Branch Chief)?

B. Use of Ecological Information

4. Do you know of any regulatory decisions or actions that have been justified by citing ecological risks alone, or instances where ecological risks were a dominant or driving concern for an Agency decision or action? Please specify the ecological concern(s) and help us locate where statements of these concerns can be found in Agency memoranda, Federal Register notices, or other EPA documents.
5. Are ecological risk management decisions documented and tracked over time? If so, please describe.
6. Identify the ecological concern or value used to justify decisions made by your office. In other

words, what are you trying to protect? For example, does your office address concerns about:

- Nonhuman species in general?
- Endangered or threatened species?
- Aquatic or terrestrial populations?
- Natural habitats (e.g., wetlands, National Wildlife Refuges)?
- Other natural communities, ecosystems, or landscapes?

Does your office focus on chemical, physical, biological, and/or radiological stresses to nonhuman receptors? Does your office focus on acute, subacute, and/or chronic stresses (i.e., short- or long-term stresses); single or cumulative stresses; or lethal or nonlethal effects?

7. Environmental measurements (e.g., toxicity test results, acres of wetland lost) are typically used to quantitatively assess whether a particular ecological value is protected. If a quantitative threshold level of unreasonable ecological risk has been established by your office, please inform us what it is.
8. Has any case law shaped how you think about or define ecological risk concerns? Please cite.
9. Are the results of ecological risk assessments used in any economic analyses (i.e., cost/benefit, cost effectiveness, risk/benefit, or valuation analyses)? If so, how?

C. Management and Guidance Issues

10. Does anything limit ecological risk management decisions within your office (e.g., limitations in data or staff expertise, office culture)? Identify the areas of greatest controversy both within your office and with outside groups about the

ecological scope of your program. What is your best idea for improving risk management decisions in your program?

11. Does your program plan to implement the concepts found in the *Framework for Ecological Risk Assessment*? If so, how?

12. Identify any major ecological risk management issues in your office that would benefit from guidance.

13. Describe any formal and informal guidance (i.e., established policies and procedures) that your office uses to incorporate ecological concerns into decisions. Where may we obtain copies of such guidance?

14. Do you think any of your formal or informal guidance (e.g., standard operating procedures, ad hoc approaches, or unwritten policies and procedures) could be helpful or more broadly applied as guidance to other offices within the Agency? If so, please suggest which ones.

Appendix C

EPA Program Areas Interviewed

Acronym	Office, Division, Branch, and/or Staff
AIR (ACID DEP)	Office of Air and Radiation, Office of Atmospheric Programs, Acid Rain Division, Headquarters.
AIR (OAQPS)	Office of Air and Radiation, Office of Air Quality and Planning Standards, Headquarters.
AIR (STRAT)	Office of Air and Radiation, Stratosphere Protection Division, Analysis and Review Branch, Headquarters.
AIR (TOXICS, R5)	Air and Radiation Division, Region 5.
GLNPO (R5)	Great Lakes National Program Office, Region 5.
NEPA (OFA)	Office of Federal Activities, Headquarters.
NEPA (R3)	Environmental Services Division, Environmental Assessment Branch, Region 3.
NEPA (R5)	Planning and Management Division, Planning Assessment Branch, Region 5.
NEPA (R9)	Office of External Affairs, Region 9.
PESTICIDES (HQ)	Office of Pesticide Programs, Environmental Fate and Effects Division, Headquarters.
PESTICIDES (R5)	Environmental Services Division, Pesticides and Toxic Substances Branch, Region 5.
PESTICIDES (R10)	Environmental Services Division, Pesticides and Toxic Substances Branch, Region 10.
RCRA (HQ)	Office of Solid Waste and Emergency Response, Headquarters.
RCRA (R3)	RCRA Program (Corrective Action and Enforcement Sections), Region 3.
RCRA (R5)	Waste Management Division, Region 5.
RCRA (R10)	Region 10.
SF ESTUARY (R9)	San Francisco Bay Estuary Project, Region 9.
SUPERFUND (HQ)	Office of Solid Waste and Emergency Response, Office of Emergency and Remedial Response (Superfund), Headquarters.
SUPERFUND (R3)	Hazardous Waste Management Division, Region 3.
SUPERFUND (R5)	Waste Management Division, Region 5.
SUPERFUND (R9)	Technical Support Section, Region 9.
SUPERFUND (R10)	Hazardous Waste Division, Region 10.
TOXICS (BIOTECH)	Office of Prevention, Pesticides and Toxic Substances, Office of Pollution Prevention and Toxics, Health and Environmental Review Division, Environmental Effects Branch, Biotechnology Review Staff, Headquarters.

TOXICS (ECAD)	Office of Prevention, Pesticides and Toxic Substances, Office of Pollution Prevention and Toxics, Health and Environmental Review Division, Environmental Effects Branch, Headquarters. (This survey is about existing chemicals and the Dioxin/Sludge Assessment.)
TOXICS (PMN)	Office of Prevention, Pesticides and Toxic Substances, Office of Pollution Prevention and Toxics, Health and Environmental Review Division, Environmental Effects Branch, Headquarters. (This survey focuses on the premanufacture notification process.)
WATER (CRITERIA)	Office of Water, Office of Science and Technology, Health and Ecological Criteria Division, Headquarters.
WATER (NONPOINT)	Office of Water, Office of Wetlands, Oceans and Watersheds, Assessment and Watershed Protection Division, Nonpoint Source Control Branch, Headquarters.
WATER (OCN DSCHRG)	Office of Water, Office of Wetlands, Oceans and Watersheds, Oceans and Coastal Protection Division, Marine Pollution Control Branch, Headquarters.
WATER (PERMITS, R9)	Water Management Division, Permits and Compliance Branch, Region 9.
WATER (QUALITY, R9)	Water Management Division, Water Quality Branch, Region 9.
WATER (SLUDGE)	Office of Water, Office of Science and Technology, Health and Ecological Criteria Division, Sludge Risk Assessment Branch, Headquarters.
WATER (SURFACE, R10)	Water Division, Surface Water Branch, Region 9.
WATER (WETLANDS)	Office of Water, Office of Wetlands, Oceans and Watersheds, Headquarters.
WATER (WETLANDS, R9)	Policy, Wetlands and Coastal Planning Section, Region 9.
WATER (WETLANDS, R10)	Wetlands Team, Region 10.

Appendix D

Ecological Concerns Identified by the Survey

This Appendix analyzes EPA's ecological concerns (i.e., those documented as being used in Agency decisions) to see whether specific EPA programs consider:

1. Different levels of biological organization
2. Chemical, physical, and/or biological stressors
3. Aquatic, wetland, or terrestrial habitat/ecosystem concerns
4. General types of organisms
5. Endangered and threatened species

The sections below discuss these five considerations in more detail. Table D-1 lists, by program area, the data subset used for these analyses. Table D-7 presents all ecological concerns identified by the survey (those with and without documentation of being used in an Agency decision).

D.1 Classification by Levels of Biological Organization

In Table D-2, an attempt is made to classify EPA's ecological concerns by level of biological organization. This classification is more of a reflection of the regulatory environment in which these endpoints have been derived and does not use scientific designations of the "levels of biological organization" (e.g., cell → organ → individual → population → community → ecosystem → landscape → biome). Plants and animals listed under the Endangered Species Act are excluded from Table D-2 and are treated separately in Section D-5 and Table D-6 later in this Appendix.

EPA's ecological concerns can be classified as relating to:

- Category 1: Groups of individuals
- Category 2: Local populations
- Category 3: Multiple species
- Category 4: Habitats/ecosystems

The first category recognizes that, aside from endangered species, the Agency does not regulate for adverse effects on the health of or for the death of an individual nonhuman organism. No case was found where an

individual organism or even a small number of individuals (regardless of their species type) were protected by regulatory activity. Thus, rather than calling this level the "organism or individual" level (to better match the scientific understanding of these terms), it seems most appropriate to use the expression "groups of individuals." Concerns listed here are generally about the magnitude and extent of an effect (e.g., number of animals killed) without regard to the types or numbers of species being affected.

Human health risk assessment is concerned with both the health and mortality of an *individual person* (albeit EPA does allow cancer risks on the order of one individual in a million in the general population and one individual in ten thousand in worker populations). In ecological risk assessment, however, EPA is rarely, if ever, truly concerned with the health or mortality of an *individual organism*.

There are notable occasions, however, when society expresses an avid desire to protect individual animals. An example occurred in 1988, when massive efforts were undertaken to free a group of three gray whales trapped by ice in the Arctic Ocean. In the regulatory environment, the closest that EPA comes to protecting individual organisms occurs in cases involving endangered species. This is a direct result of society's intentions to prevent species extinctions through the Endangered Species Act. Thus, EPA's concern appears not to be the health or mortality of individuals per se but only of those individuals that are necessary for the survival of a species.

The survey indicates that acute mortality appears to be the most often and widely used concern within EPA. Perhaps one reason for this is the preponderance of laboratory toxicity test data on acute mortality. Another may be that mortality is a more obvious and easily documented sign of environmental stress than chronic or sublethal effects. For example, in a much publicized decision under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the pesticide diazinon was restricted in its use on golf courses and sod farms. This occurred after documentation of "widespread and repeated" incidents of bird mortality after ingestion of the pesticide. These incidents were not evidence of long-term changes in bird population levels. Neither was the

Table D-1. EPA's Ecological Concerns Organized by Program Area

Program Area	Valued Ecological System or Component	Concern(s)
AIR (ACID DEP)	Biological diversity (i.e., aquatic species diversity)	Not specified
AIR (ACID DEP)	Fish (sportfish)	Not specified
AIR (ACID DEP)	Resources (aquatic)	Adverse effects in general
AIR (ACID DEP)	Species (aquatic)	Adverse effects in general
AIR (ACID DEP)	Water quality	Adverse water chemistry conditions
AIR (ACID DEP)	Wilderness Areas (i.e., Congressionally protected areas within National Forests)	Not specified
AIR (OAQPS)	Life (aquatic)	Not specified
AIR (OAQPS)	Vegetation (sensitive, terrestrial)	Acute and chronic effects
GLNPO (R5)	Habitats (vital for the support of healthy and diverse communities of plants, fish, and wildlife; emphasis on wetlands)	Not specified
GLNPO (R5)	Water	Reduction of level of toxic substances in the Great Lakes and surrounding habitat
NEPA (OFA)	Environments (terrestrial and aquatic)	"Potential for significant environmental degradation"
NEPA (OFA)	Environments (terrestrial and aquatic)	"Severity, duration, or geographic scope of impacts"
NEPA (OFA)	Environments (terrestrial and aquatic)	Violation of a "national environmental standard"
NEPA (OFA)	Environments (terrestrial and aquatic)	"Significant environmental impacts"
NEPA (OFA)	Habitat (aquatic)	Loss of habitat
NEPA (OFA)	Habitat (remote aquatic and terrestrial habitats)	Acute and chronic effects
NEPA (OFA)	Resources (terrestrial and aquatic)	"Threat to national environmental resources..."
NEPA (OFA)	Water (surface waters)	Potential for damage
NEPA (OFA)	Water quality	Potential impacts
NEPA (OFA)	Wildlife (especially aquatic and terrestrial endangered species)	Not specified
NEPA (R3)	Bird habitat ("excellent habitat for waterfowl")	Acute and chronic effects
NEPA (R3)	Ecosystems (aquatic)	Acute and chronic effects
NEPA (R3)	Habitat (sensitive terrestrial and aquatic areas)	Federal projects that promote development in sensitive areas
NEPA (R3)	National Forests	Acute and chronic effects
NEPA (R3)	Resources (natural; terrestrial and aquatic)	Acute and chronic effects
NEPA (R3)	Resources (sensitive terrestrial and aquatic)	Avoidance of adverse effects
NEPA (R3)	Riparian habitats	Acute effects; loss of riparian areas
NEPA (R3)	Streams	Acute and chronic effects
NEPA (R3)	Water supply	Chronic effects; potential impacts

Table D-1. EPA's Ecological Concerns Organized by Program Area (*continued*)

Program Area	Valued Ecological System or Component	Concern(s)
NEPA (R3)	Wetlands	Acute effects; loss of wetlands
NEPA (R3)	Wetlands	Chronic effects; potential impacts
NEPA (R5)	Biological diversity (terrestrial)	Acute and chronic effects; potential reduction in species diversity
NEPA (R5)	Ecosystems (rare, terrestrial)	Acute and chronic effects
NEPA (R5)	Habitats (high-quality terrestrial habitats)	Acute and chronic effects
NEPA (R9)	Biological diversity (terrestrial and aquatic; preservation of)	Not specified
NEPA (R9)	Ecosystems (aquatic)	Acute and chronic effects; discharge of high loads of selenium
NEPA (R9)	Endangered and threatened species	Not specified
NEPA (R9)	Fish (surface waters, juvenile salmonids)	Adverse hydrologic
NEPA (R9)	Habitats (special rare aquatic and terrestrial habitats, e.g., coastal sage-scrub)	Not specified
NEPA (R9)	Native species (terrestrial)	Invasive species and exotic species
NEPA (R9)	Refuges (state and federal)	Not specified
NEPA (R9)	Riparian habitat (aquatic and terrestrial aspects of)	Not specified
NEPA (R9)	Water (e.g., rivers, sloughs, and streams)	Not specified
NEPA (R9)	Water quality	Acute and chronic effects; use of water quality standards
NEPA (R9)	Wetlands	Adverse hydrologic
NEPA (R9)	Wildlife (terrestrial and aquatic)	"Unacceptable hazards"
PESTICIDES (HQ)	Birds	Acute mortality (recurring incidents of bird kills)
PESTICIDES (HQ)	Mollusks (aquatic; nontarget and commercial)	Acute and chronic effects
PESTICIDES (HQ)	Endangered and threatened species	Acute effects; secondary toxicity; cumulative, reproductive, or chronic effects; effects on habitat or food supply
PESTICIDES (R5)	Birds (migratory birds)	Acute mortality
PESTICIDES (R5)	Vegetation (nontarget terrestrial plants)	Not specified
RCRA (R3)	Communities (aquatic; use of AWQC)	Acute and chronic effects
SUPERFUND (HQ)	Coastal barriers	Not specified
SUPERFUND (HQ)	Endangered species critical habitat	Acute and chronic effects
SUPERFUND (HQ)	Habitat (breeding areas for large or dense aggregations of terrestrial animals)	Not specified
SUPERFUND (HQ)	Habitat (critical spawning and feeding areas, e.g., fish, shellfish, and anadromous fish)	Not specified
SUPERFUND (HQ)	Habitat (unique communities)	Not specified
SUPERFUND (HQ)	Marine sanctuaries	Not specified

Table D-1. EPA's Ecological Concerns Organized by Program Area (continued)

Program Area	Valued Ecological System or Component	Concern(s)
SUPERFUND (HQ)	National and state wildlife refuges	Not specified
SUPERFUND (HQ)	National estuaries	Not specified
SUPERFUND (HQ)	National parks	Not specified
SUPERFUND (HQ)	Wild and scenic rivers	Not specified
SUPERFUND (R3)	Birds (migratory waterfowl)	Potential adverse effects
SUPERFUND (R3)	Endangered and threatened species	Not specified
SUPERFUND (R3)	Species (aquatic and terrestrial)	Not specified
SUPERFUND (R3)	Wetland (restoration)	Not specified
SUPERFUND (R5)	Benthic organisms	Sediment contamination
SUPERFUND (R5)	Wildlife (terrestrial and aquatic; use of NOAELs and LOAELs)	Acute and chronic effects
SUPERFUND (R10)	Benthic communities (surrogates for exposed and valued aquatic ecosystems)	Acute and chronic effects; use of AET for benthic invertebrate communities
SUPERFUND (R10)	Fish (health of fishery populations)	Chronic effects
SUPERFUND (R10)	Food chain/food web (wildlife)	Bioaccumulation
TOXICS (PMN)	Algae	Acute or chronic effects; expected exceedance of an aquatic "concentration of concern"
TOXICS (PMN)	Fish	Acute or chronic effects; expected exceedance of an aquatic "concentration of concern"
TOXICS (PMN)	Invertebrates (aquatic; daphnia)	Acute or chronic effects; expected exceedance of an aquatic "concentration of concern"
WATER (CRITERIA)	Community (aquatic)	Acute and chronic effects
WATER (CRITERIA)	Endangered species	Acute and chronic effects
WATER (CRITERIA)	Fish	Acute and chronic effects; sublethal
WATER (CRITERIA)	Invertebrates (aquatic)	Acute and chronic effects; sublethal
WATER (CRITERIA)	Species (commercially important, including salmonids)	Acute and chronic effects
WATER (CRITERIA)	Vegetation (aquatic plants)	Acute and chronic effects
WATER (OCN DSCHRG)	Benthic organisms	Acute and chronic effects
WATER (OCN DSCHRG)	Endangered and threatened species	Acute and chronic effects
WATER (OCN DSCHRG)	Food chain/food web	Acute and chronic effects
WATER (OCN DSCHRG)	Habitats (aquatic; natural, special, or sensitive)	Acute and chronic effects
WATER (OCN DSCHRG)	Populations (balanced indigenous)	Acute and chronic effects
WATER (OCN DSCHRG)	Species (water column)	Acute and chronic effects
WATER (PERMITS, R9)	Amphibians or reptiles ("herps of special interest")	Not specified
WATER (PERMITS, R9)	Benthic organisms	Not specified

Table D-1. EPA's Ecological Concerns Organized by Program Area (*continued*)

Program Area	Valued Ecological System or Component	Concern(s)
WATER (PERMITS, R9)	Birds ("of special interest")	Not specified
WATER (PERMITS, R9)	Endangered species	Not specified
WATER (PERMITS, R9)	Fish	Water temperature and flow on chinook population sizes
WATER (PERMITS, R9)	Habitat (upland, terrestrial)	Not specified
WATER (PERMITS, R9)	Habitats (intertidal)	Not specified
WATER (PERMITS, R9)	Habitats (subtidal)	Not specified
WATER (PERMITS, R9)	Mammals (terrestrial)	Not specified
WATER (PERMITS, R9)	Riparian habitat	Not specified
WATER (PERMITS, R9)	Vegetation (aquatic; water channel characteristics)	Not specified
WATER (PERMITS, R9)	Vegetation (terrestrial and aquatic)	Acute and chronic effects
WATER (PERMITS, R9)	Water (open water)	Not specified
WATER (PERMITS, R9)	Wetlands (as habitat)	Not specified
WATER (QUALITY, R9)	Benthic invertebrates (aquatic)	Chronic effects
WATER (QUALITY, R9)	Fish	Not specified
WATER (QUALITY, R9)	Life (aquatic)	Acute and chronic effects
WATER (SF ESTUARY, R9)	Estuary	Chronic effects; toxic sediment accumulation
WATER (SF ESTUARY, R9)	Estuary	Reduction of pollutant loadings to estuary
WATER (SF ESTUARY, R9)	Food chain/food web (terrestrial and aquatic)	Bioaccumulation
WATER (SF ESTUARY, R9)	Water	Unnecessary dredging activities
WATER (SF ESTUARY, R9)	Water	Avoid/offset adverse impacts of dredging, flood control, and development
WATER (SF ESTUARY, R9)	Wetlands (as habitat; protection, restoration, and increase in)	Not specified
WATER (SLUDGE)	Vegetation (crops)	Phytotoxicity
WATER (WETLANDS)	Birds (wading bird rookeries)	Acute and chronic effects
WATER (WETLANDS)	Endangered species	Acute and chronic effects
WATER (WETLANDS)	Fish (high-quality trout streams)	Acute and chronic effects
WATER (WETLANDS)	Wetlands (type)	Loss of unique or scarce wetland types
WATER (WETLANDS)	Wetlands (wetland functions)	Acute and chronic effects
WATER (WETLANDS)	Wetlands (wetland organisms)	Acute and chronic effects
WATER (WETLANDS, R9)	Endangered and threatened species	Acute and chronic effects
WATER (WETLANDS, R9)	Fish	Acute and chronic effects

Table D-1. EPA's Ecological Concerns Organized by Program Area (*continued*)

Program Area	Valued Ecological System or Component	Concern(s)
WATER (WETLANDS, R9)	Wetlands (maintenance and increase in wetland functions and values)	Acute and chronic effects
WATER (WETLANDS, R10)	Birds (nesting habitat for tundra swans and other migratory waterfowl)	Not specified
WATER (WETLANDS, R10)	Birds (tundra swans)	Not specified
WATER (WETLANDS, R10)	Deltas (restoration of)	Acute and chronic effects
WATER (WETLANDS, R10)	Endangered and threatened species	Not specified
WATER (WETLANDS, R10)	Endangered and threatened species (protect current habitats of)	Acute and chronic effects
WATER (WETLANDS, R10)	Endangered and threatened species (protect current populations of)	Acute and chronic effects
WATER (WETLANDS, R10)	Habitats (aquatic; e.g., juvenile salmon nurseries, eel grass beds)	Acute and chronic effects
WATER (WETLANDS, R10)	Habitats (migratory bird flyways)	Acute and chronic effects
WATER (WETLANDS, R10)	Vegetation (i.e., deep pendent grass, a food source for waterfowl)	Potential damage
WATER (WETLANDS, R10)	Wetlands	Acute and chronic effects; loss of acreage
WATER (WETLANDS, R10)	Wetlands (protect a variety of)	Acute and chronic effects
WATER (WETLANDS, R10)	Wetlands (protection of an interconnected system of wetlands within a sustainable, ecologically sound system)	Acute and chronic effects

decision to cancel these uses of diazinon based on a concern for individual birds, nor for particular species of birds, nor small numbers of birds. These incidents included large numbers of dead birds of various species. Furthermore, the restrictions were based on uses of diazinon where the benefits of its use were not deemed to be particularly valuable.

Many ecologists feel that looking at chronic and sublethal effects is essential, and in fact many EPA offices have historically considered both acute and chronic, lethal and sublethal chemical effects. There were, however, only a few cases documented in this report where regulatory action was taken solely based on chronic or sublethal effects occurring to wildlife or habitats. Examples involved a wetland (Office of Federal Activities), benthic invertebrates and an estuary (Office of Water), and a fishery population (Superfund). No cases were found where regulatory action was based on chronic or sublethal effects to plants. The Office of Pesticides Programs (OPP) has made a few regulatory decisions, in part based on chronic or sublethal effects to birds (e.g., DDT and mirex) (see the PESTICIDES [HQ] summary in Appendix F).

The second category is a population category. When considered, EPA typically focuses on declines or

extinctions of a local population at a particular site. One example would include acid deposition leading to extinctions of entire populations of nontolerant fish in a northeastern lake. Examples in the local population category in Table D-2 uncovered by the survey include declines in commercial and sportfish/shellfish. No terrestrial examples were found. It is important to note that most ecological risk assessments at EPA technically fall short of considering population level effects.

"Multiple species" in Table D-2 simply means considerations protective of more than one species of birds, fish, other animal taxa, plants, or any combination thereof. This term was carefully chosen instead of the classical scientific definition of "community." The term was selected because most multiple species analyses at EPA used in regulatory analysis do not consider *interactions* among different species (i.e., a critical aspect in the science of community ecology).

Perhaps the best example of multiple species concerns at EPA is the use of AWQC. AWQC are designed to establish chemical concentrations which, if not exceeded more than once in 3 years, should be protective of 95 percent of aquatic species in most aquatic systems. Toxicity information on a chemical's effect on a range of taxonomic orders and families is used to calculate an

Table D-2. Levels of Biological Organization Considered by EPA^a

Program Area	Groups of Individuals	Local Population	Multiple Species	Habitat/Ecosystem
AIR (ACID DEP)				
AIR (OAQPS)				
AIR (STRAT)				
AIR (TOXICS, R5)				
NEPA (OFA)				
NEPA (R3)				
NEPA (R5)				
NEPA (R9)				
PESTICIDES (HQ)				
PESTICIDES (R5)				
PESTICIDES (R10)				
TOXICS (BIOTECH)				
TOXICS (ECAD)				
TOXICS (PMN)				
RCRA (HQ)				
RCRA (R3)				
RCRA (R5)				
RCRA (R10)				
SUPERFUND (HQ)				
SUPERFUND (R3)				
SUPERFUND (R5)				
SUPERFUND (R9)				
SUPERFUND (R10)				
WATER (CRITERIA)				
WATER (NONPOINT)				
WATER (OCN DSCHRG)				
WATER (PERMITS, R9)				
WATER (QUALITY, R9)				
WATER (SF ESTUARY, R9)				
WATER (SLUDGE)				
WATER (WETLANDS)				
WATER (WETLANDS, R9)				
WATER (WETLANDS, R10)				
GLNPO (R5)				

	Regularly used		One known example
	Occasionally used		Not considered/ No documented example

^a Scores were assigned through the best professional judgment of the authors.

AWQC. These criteria are not concerned with community or ecosystem effects if an AWQC is reached or exceeded. Instead, the acute criterion, for example, is simply a prediction of a chemical concentration in water above which acute toxicity to some species may occur. (Implicit here is the assumption that protecting a group of individual species will protect the community. This assumption is widespread at EPA and elsewhere, although its validity is the subject of considerable debate.) Nevertheless, AWQC are easy and practical to use, and the use of AWQC implies a concern for the protection of more than one aquatic species (U.S. EPA, 1988).

Finally, the habitat/ecosystem level represents concerns about entire systems and their values, rather than being species-oriented. Generally, habitat/ecosystem level regulatory analyses at EPA do not consider interactions among animal and plant communities and their abiotic environment (the classic ecological definition of an ecosystem). EPA, however, does pay considerable attention to protecting wetlands, estuaries, and large natural resources such as the Great Lakes and San Francisco Bay.

D.2 Classification by Chemical, Physical, and/or Biological Stressors

Those interviewed were asked whether they considered chemical, physical, or biological stressors to ecological receptors (see Table D-3). In general (as expected), all offices uniformly consider chemical stressors and impacts. The biological stressor category tends to include concerns about exotic or non-native species (e.g., invasions of zebra mussels and brown-headed cowbirds). Many of the physical stressors considered are generally within the context of various permitting sections of the Clean Water Act (i.e., protecting wetlands and coastal and riparian areas through the use of existing regulations on dredge-and-fill activities in navigable waters of the United States). Physical stressors appear to be considered consistently only within the National Environmental Policy Act (NEPA) and Water programs.

D.3 Classification by Aquatic, Wetland, or Terrestrial Habitat/Ecosystem Concerns

Much of EPA's concerns with habitats and ecosystems can be seen in two major programs. One of these is the NEPA Environmental Impact Statement (EIS) review function within the Office of Federal Activities and several Regional offices (see Table D-4). This function is primarily advisory in nature and pertains to other federal agencies and their large-scale projects. Water programs also exhibit habitat/ecosystem level concerns, as evidenced by geographic initiatives such as the San Francisco Estuary and other program areas that regulate wetlands and ocean discharges.

D.4 Classification by General Types of Organism

Table D-5 suggests that animals are more frequently assessed as a value of ecological concern than plants. It also suggests that aquatic species are assessed more frequently than terrestrial ones. This is in agreement with Table D-4, which included the habitat/ecosystem endpoints. In the interviews, it was observed that, more often than not, the animal species considered are not endangered or threatened species. General sorts of references to biological diversity or unspecified aquatic or terrestrial habitats or ecosystems are not included in this table. General references to "wildlife" are included.

D.5 Classification by Endangered and Threatened Species

Table D-6 identifies program offices that provided documentation to support that they consider species listed under the Endangered Species Act (ESA). They include the Office of Federal Activities, the Office of External Affairs (Region 9), and offices within the Pesticides, Superfund, and Water programs. Populations and/or critical habitats of federally listed endangered species are also a concern for some program offices. More details about historical or proposed program office activities in protecting endangered species can be found in U.S. EPA (1993).

Table D-7 presents all ecological concerns identified by the survey (organized by program area), including concerns used in Agency decisions/actions; concerns used in ongoing assessments; ecological systems or components identified as possible future endpoints; and concerns mentioned by EPA staff without supporting documentation on their actual use. For each ecological concern listed, the general source of information is identified. Specific citations are found in the interview summaries in Appendix F.

D.6 References

- U.S. EPA. 1988. Review of ecological risk assessment methods. EPA/230/10-88/041. Washington DC: Office of Policy Analysis, Office of Policy, Planning, and Evaluation.
- U.S. EPA. 1993. Endangered species background paper. Memorandum from Howard Corcoran, Associate Counsel, Grants and Intergovernmental Division, to Michael P. Vandenbergh, Senior Policy Advisor, Office of the Administrator, and Jonathan C. Fox, Special Assistant, Office of the Administrator. Washington, DC (June 30).

Table D-3. Types of Stressors Considered by EPA

Program Area	Types of Stressors		
	Chemical	Physical	Biological
AIR (ACID DEP)			
AIR (OAQPS)			
AIR (STRAT)			
AIR (TOXICS, R5)			
NEPA (OFA)			
NEPA (R3)			
NEPA (R5)			
NEPA (R9)			
PESTICIDES (HQ)			
PESTICIDES (R5)			
PESTICIDES (R10)			
TOXICS (BIOTECH)			
TOXICS (ECAD)			
TOXICS (PMN)			
RCRA (HQ)			
RCRA (R3)			
RCRA (R5)			
RCRA (R10)			
SUPERFUND (HQ)			
SUPERFUND (R3)			
SUPERFUND (R5)			
SUPERFUND (R9)			
SUPERFUND (R10)			
WATER (CRITERIA)			
WATER (NONPOINT)			
WATER (OCN DSCHRG)			
WATER (PERMITS, R9)			
WATER (QUALITY, R9)			
WATER (SF ESTUARY, R9)			
WATER (SLUDGE)			
WATER (WETLANDS)			
WATER (WETLANDS, R9)			
WATER (WETLANDS, R10)			
GLNPO (R5)			

Considered at least once



Not considered/No documented example

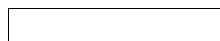


Table D-4. Aquatic, Wetland and Terrestrial Habitat/Ecosystem Considerations by EPA

Program Area	Types of Habitats/Ecosystems		
	Aquatic	Wetland	Terrestrial
AIR (ACID DEP)			
AIR (OAQPS)			
AIR (STRAT)			
AIR (TOXICS, R5)			
NEPA (OFA)			
NEPA (R3)			
NEPA (R5)			
NEPA (R9)			
PESTICIDES (HQ)			
PESTICIDES (R5)			
PESTICIDES (R10)			
TOXICS (BIOTECH)			
TOXICS (ECAD)			
TOXICS (PMN)			
RCRA (HQ)			
RCRA (R3)			
RCRA (R5)			
RCRA (R10)			
SUPERFUND (HQ)			
SUPERFUND (R3)			
SUPERFUND (R5)			
SUPERFUND (R9)			
SUPERFUND (R10)			
WATER (CRITERIA)			
WATER (NONPOINT)			
WATER (OCN DSCHRG)			
WATER (PERMITS, R9)			
WATER (QUALITY, R9)			
WATER (SF ESTUARY, R9)			
WATER (SLUDGE)			
WATER (WETLANDS)			
WATER (WETLANDS, R9)			
WATER (WETLANDS, R10)			
GLNPO (R5)			
Considered at least once			
Not considered/No documented example			

Table D-5. General Types of Organisms Considered by EPA

Program Area	Fish	Birds	Wildlife	Plants	Benthic Organisms	Aquatic Invertebrates (e.g., daphnia)	Mollusks/ Shellfish	Reptiles or Amphibians	Algae	Micro-organisms
AIR (ACID DEP)										
AIR (OAQPS)										
AIR (STRAT)										
AIR (TOXICS, R5)										
NEPA (OFA)										
NEPA (R3)										
NEPA (R5)										
NEPA (R9)										
PESTICIDES (HQ)										
PESTICIDES (R5)										
PESTICIDES (R10)										
TOXICS (BIOTECH)										
TOXICS (ECAD)										
TOXICS (PMN)										
RCRA (HQ)										
RCRA (R3)										
RCRA (R5)										
RCRA (R10)										
SUPERFUND (HQ)										
SUPERFUND (R3)										
SUPERFUND (R5)										
SUPERFUND (R9)										
SUPERFUND (R10)										
Considered at least once										
Not considered/No documented example										

Table D-5. General Types of Organisms Considered by EPA (continued)

Program Area	Fish	Birds	Wildlife	Plants	Benthic Organisms	Aquatic Invertebrates (e.g., daphnia)	Mollusks/ Shellfish	Reptiles or Amphibians	Algae	Micro- organisms
WATER (CRITERIA)										
WATER (NONPOINT)										
WATER (OCN DSCHRG)										
WATER (PERMITS, R9)										
WATER (QUALITY, R9)										
WATER (SF ESTUARY, R9)										
WATER (SLUDGE)										
WATER (WETLANDS)										
WATER (WETLANDS, R9)										
WATER (WETLANDS, R10)										
GLNPO (R5)										

Considered at least once



Not considered/No documented
example

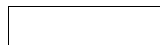


Table D-6. EPA Offices That Consider Endangered Species

Program Area	
AIR (ACID DEP)	
AIR (OAQPS)	
AIR (STRAT)	
AIR (TOXICS, R5)	
NEPA (OFA)	
NEPA (R3)	
NEPA (R5)	
NEPA (R9)	
PESTICIDES (HQ)	
PESTICIDES (R5)	
PESTICIDES (R10)	
TOXICS (BIOTECH)	
TOXICS (ECAD)	
TOXICS (PMN)	
RCRA (HQ)	
RCRA (R3)	
RCRA (R5)	
RCRA (R10)	
SUPERFUND (HQ)	
SUPERFUND (R3)	
SUPERFUND (R5)	
SUPERFUND (R9)	
SUPERFUND (R10)	
WATER (CRITERIA)	
WATER (NONPOINT)	
WATER (OCN DSCHRG)	
WATER (PERMITS, R9)	
WATER (QUALITY, R9)	
WATER (SF ESTUARY, R9)	
WATER (SLUDGE)	
WATER (WETLANDS)	
WATER (WETLANDS, R9)	
WATER (WETLANDS, R10)	
GLNPO (R5)	
Considered at least once	
Not considered/No documented example	

Table D-7. All Ecological Concerns Identified by the Survey

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
1	AIR (ACID DEP)	Biological diversity (i.e., aquatic species diversity)		Chemical toxicity	Yes	Interview	Emissions reduction program
2	AIR (ACID DEP)	Fish (sportfish)		Chemical toxicity	Yes	Interview	Emissions level?
3	AIR (ACID DEP)	Resources (aquatic)	Adverse effects in general	Chemical toxicity	Yes	Interview	Emissions reduction program
4	AIR (ACID DEP)	Species (aquatic)	Adverse effects in general	Chemical toxicity	Yes	Interview	Emissions reduction program
5	AIR (ACID DEP)	Water quality	Adverse effects on water chemistry	Chemical toxicity	Yes	Interview	
6	AIR (ACID DEP)	Wilderness areas (i.e., Congressionally protected areas within National Forests)		Chemical toxicity	Yes	Guidance	
7	AIR (OAQPS)	Life (aquatic)		Chemical toxicity	Yes	Decision	Sulfuric acid deposition, PSD/emissions
8	AIR (OAQPS)	Life (aquatic)		Chemical toxicity	Yes	Decision	S, N, and ozone emissions, PSD/emissions
9	AIR (OAQPS)	Vegetation (sensitive, terrestrial)	Acute and chronic effects	Chemical toxicity	Yes	Decision	S, N, and ozone emissions, PSD permit/emission total
10	AIR (OAQPS)	Vegetation (terrestrial)	Physical damage, e.g., foliar damage, decreased tree yields	Chemical toxicity	Partial	Decision	Sulfuric acid production unit emissions, emission level?
11	AIR (OAQPS)	Vegetation (terrestrial)	Fluorosis effects on both vegetation and cattle	Chemical toxicity	Partial	Decision	Aluminum reduction plant emissions, emissions level?
12	AIR (STRAT)	Algae	Chronic effects; expected exceedance of a pesticide aquatic "concentration of concern"	Chemical toxicity	No	Measurement endpoint	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
13	AIR (STRAT)	Fish	Chronic effects; expected exceedance of a pesticide aquatic "concentration of concern"	Chemical toxicity	No	Measurement endpoint	
14	AIR (STRAT)	Invertebrates (aquatic; daphnia)	Chronic effects; expected exceedance of a pesticide aquatic "concentration of concern"	Chemical toxicity	No	Measurement endpoint	
15	AIR (TOXICS, R5)	Food chain/food web (aquatic)	Potential bioaccumulation	Chemical toxicity	No	Inference from emissions inventory	
16	AIR (TOXICS, R5)	Life (aquatic)	Chronic effects	Chemical toxicity	No	Inference from emissions inventory	
17	GLNPO (R5)	Habitats (vital for the support of healthy and diverse communities of plants, fish, and wildlife; emphasis on wetlands)		Chemical, physical, and biological stressors	Yes	Plan	
18	GLNPO (R5)	Water	Reduction of level of toxic substances in the Great Lakes and surrounding habitat	Chemical toxicity	Yes	Plan	
19	NEPA (OFA)	Environments (terrestrial and aquatic)	"Potential for significant environmental degradation"	Chemical, physical, and biological stressors	Yes	Guidance	Environmental impact rating
20	NEPA (OFA)	Environments (terrestrial and aquatic)	"Severity, duration, or geographic scope of impacts"	Chemical, physical, and biological stressors	Yes	Guidance	Environmental impact rating
21	NEPA (OFA)	Environments (terrestrial and aquatic)	Violation of a "national environmental standard"	Chemical, physical, and biological stressors	Yes	Guidance	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
22	NEPA (OFA)	Environments (terrestrial and aquatic)	"Significant environmental impacts"	Chemical, physical, and biological stressors	Yes	Guidance	Environmental impact rating
23	NEPA (OFA)	Habitat (aquatic)	Loss of habitat	Chemical toxicity	Yes	Decision	TVA barge terminals project, EU rating
24	NEPA (OFA)	Habitat (remote aquatic and terrestrial habitats)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Appalachian Corridor H, EU rating
25	NEPA (OFA)	Resources (terrestrial and aquatic)	"Threat to national environmental resources..."	Chemical, physical, and biological stressors	Yes	Guidance	Environmental impact rating
26	NEPA (OFA)	Water (surface waters)	Potential for damage	Chemical toxicity	Yes	Decision	DOA APHIS grasshopper control project, EU rating?
27	NEPA (OFA)	Water quality	Potential impacts	Chemical toxicity	Yes	Decision	TVA barge terminals project, EU rating
28	NEPA (OFA)	Wildlife (especially aquatic and terrestrial endangered species)		Chemical toxicity	Yes	Decision	DOA APHIS grasshopper control project, EIS rating
29	NEPA (R3)	Bird habitat ("excellent habitat for waterfowl")	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Woodrow Wilson Bridge improvement project, EC rating
30	NEPA (R3)	Ecosystems (aquatic)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Appalachian Corridor H, proposed highway, WV; EU rating
31	NEPA (R3)	Habitat (sensitive terrestrial and aquatic areas)	Federal projects which promote development in sensitive areas	Chemical, physical, and biological stressors	Yes	Decision	Southeastern Expressway, VA; EU rating
32	NEPA (R3)	National Forests	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Appalachian Corridor H, proposed highway, WV; EU rating
33	NEPA (R3)	Resources (natural; terrestrial and aquatic)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Appalachian Corridor H, proposed highway, WV; EU rating
34	NEPA (R3)	Resources (sensitive terrestrial and aquatic)	Avoidance of adverse effects	Chemical, physical, and biological stressors	Yes	Decision	Lackawanna Valley industrial highway project, LO rating

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
35	NEPA (R3)	Riparian habitats	Acute effects; loss of riparian areas	Chemical toxicity	Yes	Decision	SCS Delmarva drainage improvement project; EU rating
36	NEPA (R3)	Streams	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Appalachian Corridor H, proposed highway, WV; EU rating
37	NEPA (R3)	Water supply	Chronic effects; potential impacts	Chemical, physical, and biological stressors	Yes	Decision	Southeastern Expressway, VA; EU rating
38	NEPA (R3)	Wetlands	Acute effects; loss of wetlands	Chemical toxicity	Yes	Decision	SCS Delmarva drainage improvement project, EU rating
39	NEPA (R3)	Wetlands	Chronic effects; potential impacts	Chemical, physical, and biological stressors	Yes	Decision	Southeastern Expressway, VA; EU rating
40	NEPA (R5)	Biological diversity (terrestrial)	Acute and chronic effects; potential reduction in species diversity	Chemical, physical, and biological stressors	Yes	Decision	Sunken Camp (Chequamegon National Forest); EO rating
41	NEPA (R5)	Ecosystems (rare, terrestrial)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Protection of high quality remnant prairie, NEPA review
42	NEPA (R5)	Habitats (high-quality terrestrial habitats)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Legal suit: underground injection wells in MI
43	NEPA (R9)	Biological diversity (terrestrial and aquatic; preservation of)		Chemical, physical, and biological stressors	Yes	Correspondence	Spirit Mountain Lake, Mohave Valley Resort, NEPA review
44	NEPA (R9)	Ecosystems (aquatic)	Acute and chronic effects; discharge of high loads of selenium	Chemical, physical, and biological stressors	Yes	Correspondence	San Luis Unit Drainage Program, NEPA review
45	NEPA (R9)	Endangered and threatened species		Chemical, physical, and biological stressors	Yes	Interview	NEPA review
46	NEPA (R9)	Fish (surface waters, juvenile salmonids)	Adverse hydrologic effects	Chemical, physical, and biological stressors	Yes	Correspondence	1000 Springs Power Plant, NEPA review

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
47	NEPA (R9)	Habitat corridors (terrestrial and aquatic)		Chemical, physical, and biological stressors	No	Interview	NEPA review
48	NEPA (R9)	Habitats (special rare aquatic and terrestrial habitats, e.g., coastal sage-scrub)		Chemical, physical, and biological stressors	Yes	Interview	Coastal sage-scrub, NEPA review
49	NEPA (R9)	Native species (terrestrial)	Invasive species and exotic species	Chemical, physical, and biological stressors	Yes	Interview	Brown-headed cowbird, NEPA review
50	NEPA (R9)	Refuges (state and federal)		Chemical, physical, and biological stressors	Yes	Interview	NEPA review
51	NEPA (R9)	Riparian habitat (aquatic and terrestrial aspects of)		Chemical, physical, and biological stressors	Yes	Interview	Glen Canyon Dam, NEPA review
52	NEPA (R9)	Water (e.g., rivers, sloughs, and streams)		Chemical, physical, and biological stressors	Yes	Interview	NEPA review
53	NEPA (R9)	Water quality	Acute and chronic effects; use of water quality standards	Chemical, physical, and biological stressors	Yes	Interview	San Luis Unit Drainage Program, NEPA review
54	NEPA (R9)	Wetlands	Adverse hydrologic effects	Chemical, physical, and biological stressors	Yes	Correspondence	1000 Springs Power Plant, NEPA review
55	NEPA (R9)	Wetlands		Chemical, physical, and biological stressors	Yes	Interview	NEPA review
56	NEPA (R9)	Wildlife (terrestrial and aquatic)	"Unacceptable hazards"	Chemical, physical, and biological stressors	Yes	Correspondence	San Luis Unit Drainage Program, NEPA review
57	PESTICIDES (HQ)	Birds	Chronic effects; reproductive effects	Chemical toxicity	Partial	Decision	
58	PESTICIDES (HQ)	Birds	Chronic, sublethal effects	Chemical toxicity	Partial	Decision	Mirex final determination: restrictions on aerial spraying
59	PESTICIDES (HQ)	Birds	Acute mortality (recurring incidents of bird kills)	Chemical toxicity	Yes	Remand decision (diazinon)	Diazinon remand decision (Administrator Reilly)
60	PESTICIDES (HQ)	Birds	Acute mortality (recurring incidents of bird kills)	Chemical toxicity	Yes	Special review (carbofuran)	Carbofuran special review

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
61	PESTICIDES (HQ)	Birds	Chronic effects; reproductive effects	Chemical toxicity	Partial	Decision	DDT administrative inquiry: canceled
62	PESTICIDES (HQ)	Birds (protection of bird populations)	Chronic effects	Chemical toxicity	Partial	Decision	DDT administrative inquiry: canceled
63	PESTICIDES (HQ)	Endangered and threatened species	Acute effects; secondary toxicity; cumulative, reproductive, or chronic effects; effects on habitat or food supply	Chemical toxicity	Yes	Pilot program; Federal Register notice; report to Congress	
64	PESTICIDES (HQ)	Mollusks (aquatic; nontarget and commercial)	Acute and chronic effects	Chemical toxicity	Yes	Decision	Tributyltin (TBT), restricted use
65	PESTICIDES (HQ)	Wildlife (terrestrial)	Chronic hazards	Chemical toxicity	Partial	Decision	Mirex final determination: restrictions on aerial spraying
66	PESTICIDES (R5)	Birds (migratory birds)	Acute mortality	Chemical toxicity	Yes	Decision	Diazinon user killed 47 mallards, fined \$1,000 per duck
67	PESTICIDES (R5)	Endangered species (freshwater mussels)		Chemical toxicity	No	Interview	
68	PESTICIDES (R5)	Fish	Acute mortality	Chemical toxicity	No	Interview	May use in the future, but no causal relationship has been proven
69	PESTICIDES (R5)	Vegetation (nontarget terrestrial plants)		Chemical toxicity	Yes	Decision (label change)	"Command" herbicides drifting to adjacent fields or forests, label change
70	PESTICIDES (R10)	Biological diversity (aquatic)	Chronic effects	Chemical toxicity	No	Interview	
71	PESTICIDES (R10)	Birds (in suburban areas)	Acute mortality	Chemical toxicity	No	Interview	
72	PESTICIDES (R10)	Birds (protection of residential bird populations)	Acute and chronic effects	Chemical toxicity	No	Interview	
73	PESTICIDES (R10)	Community (aquatic; structure and function of)		Chemical toxicity	No	Interview	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
74	PESTICIDES (R10)	Invertebrates (bumblebees)	Chronic effects	Chemical toxicity	No	Interview	Inferred from measurement endpoints
75	PESTICIDES (R10)	Vegetation (distribution and abundance of lichens)	Chronic effects	Chemical toxicity	No	Interview	Inferred from measurement endpoints
76	PESTICIDES (R10)	Vegetation (hydrostatic pressure in terrestrial plants)	Chronic effects	Chemical toxicity	No	Interview	Inferred from measurement endpoints
77	PESTICIDES (R10)	Vegetation (nontarget terrestrial plants)	Acute and chronic effects; reproductive and sublethal effects	Chemical toxicity	No	Interview	
78	PESTICIDES (R10)	Vegetation (seed viability in terrestrial plants)	Chronic effects	Chemical toxicity	No	Interview	Inferred from measurement endpoints
79	PESTICIDES (R10)	Vegetation (terrestrial plant community structure and function)	Chronic effects	Chemical toxicity	No	Interview	
80	RCRA (HQ)	Benthic organisms	Chronic effects; reduced abundance	Chemical, physical, and biological stressors	No	Report to Congress	Coal Utility Waste RTC
81	RCRA (HQ)	Birds	Acute mortality	Chemical, physical, and biological stressors	No	Report to Congress	Oil and Gas Waste RTC
82	RCRA (HQ)	Birds	Acute mortality	Chemical, physical, and biological stressors	No	Interview	Waterfowl landing in open cyanide pits
83	RCRA (HQ)	Birds	Acute mortality	Chemical, physical, and biological stressors	No	Interview	Carbamate production may be listed in future based on ecological endpoints.
84	RCRA (HQ)	Community (aquatic)	Acute and chronic effects; use of AWQC	Chemical toxicity	No	Decision	PCP listing
85	RCRA (HQ)	Community (aquatic)	Acute and chronic effects; use of AWQC	Chemical toxicity	No	Report to Congress	Smelting and Refining RTC, Mining Wastes RTC, and Oil and Gas RTC

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
86	RCRA (HQ)	Endangered and threatened species	Proximity of stress to their habitats	Chemical toxicity	No	Decision	Coal Utilities RIA, Oil and Gas RTC, screening-level assessment endpoint for RIAs and RTCs, but no regulatory decisions on it yet
87	RCRA (HQ)	Fish	Chronic effects; suppressed fish populations in streams	Chemical, physical, and biological stressors	No	Report to Congress	Oil and Gas Waste RTC
88	RCRA (HQ)	Fish	Acute mortality	Chemical toxicity	No	Interview	Cyanide released during mining operations
89	RCRA (HQ)	Fish	Acute mortality (in trout streams)	Chemical, physical, and biological stressors	No	Report to Congress	Oil and Gas Waste RTC
90	RCRA (HQ)	Fish	Acute mortality	Chemical toxicity	No	Report to Congress	Coal Utility Waste RTC
91	RCRA (HQ)	Food chain/food web (terrestrial and aquatic)	Bioaccumulation	Chemical toxicity	No	Guidance	Proposed Subpart S identifies bioaccumulation as a factor to consider when evaluating Corrective Action alternatives
92	RCRA (HQ)	Habitat (terrestrial)	Chronic effects; damage to deer, bear, and grouse habitat	Chemical, physical, and biological stressors	No	Report to Congress	Oil and Gas Waste RTC
93	RCRA (HQ)	Mammals (small terrestrial)	Acute mortality	Chemical, physical, and biological stressors	No	Report to Congress	Oil and Gas Waste RTC
94	RCRA (HQ)	Soil (contamination criteria)	Acute and chronic effects	Chemical, physical, and biological stressors	No	Interview	RCRA program is setting standards for protection of environment
95	RCRA (HQ)	Vegetation	Acute and chronic effects; mortality and suppressed growth	Chemical, physical, and biological stressors	No	Report to Congress	Oil and Gas Waste RTC
96	RCRA (HQ)	Wetlands (i.e., wetlands and wetland values)	Chronic effects	Chemical toxicity	No	Considered	Location Standards RIA for wetlands

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
97	RCRA (HQ)	Wildlife (terrestrial and aquatic)	Chronic adverse effects on growth, reproduction, development, or survival	Chemical toxicity	No	New	Establishing WL equivalents of human RfDs
98	RCRA (R3)	Benthic communities (aquatic macro-invertebrates; biotic indices of)		Chemical toxicity	No	Guidance	
99	RCRA (R3)	Biological diversity (aquatic; as compared to a reference area)	Chronic effects	Chemical toxicity	No	Guidance	
100	RCRA (R3)	Communities (aquatic; use of AWQC)	Acute and chronic effects	Chemical toxicity	Yes	Interview	Allied Baltimore Harbor site; RFI completed, but no ROD yet
101	RCRA (R3)	Food chain/food web (aquatic)	Bioaccumulation	Chemical toxicity	No	Guidance	
102	RCRA (R3)	Predator-prey (aquatic)	Chronic effects on predator-prey ratio	Chemical toxicity	No	Guidance	
103	RCRA (R3)	Riparian condition	Chronic effects	Chemical toxicity	No	Guidance	
104	RCRA (R3)	Species (aquatic vertebrates)	Chronic effects; observable stress	Chemical toxicity	No	Guidance	
105	RCRA (R3)	Vegetation (aquatic)	Chronic effects; vegetative stress	Chemical toxicity	No	Guidance	
106	RCRA (R3)	Vegetation (aquatic; resilience to disease)	Chronic effects; disease	Chemical toxicity	No	Guidance	
107	RCRA (R3)	Vegetation succession (aquatic)	Chronic effects	Chemical toxicity	No	Guidance	
108	RCRA (R3)	Water quality (state water quality standards)	Acute and chronic effects	Chemical toxicity	No	Interview	RFI completed, but no ROD yet
109	RCRA (R3)	Wildlife (aquatic; resilience to disease)	Chronic effects; disease	Chemical toxicity	No	Guidance	
110	RCRA (R5)	Communities (aquatic; use of AWQC)	Acute and chronic effects	Chemical toxicity	No	Interview	Permits, closures?

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
111	RCRA (R5)	Community health and structure (as compared with reference conditions; e.g., benthic and wetland communities)	Acute and chronic effects	Chemical toxicity	No	Guidance	Ansul Fire Protect Co.
112	RCRA (R5)	Endangered and threatened species (habitat)		Chemical toxicity	No	Guidance	Karner butterfly habitat at an Indiana steel mill site
113	RCRA (R5)	Fish	Acute mortality	Chemical toxicity	No	Guidance	
114	RCRA (R5)	Fish	Acute mortality (i.e., evidence of excess mortality)	Chemical toxicity	No		
115	RCRA (R5)	Food chains (terrestrial and aquatic)	Chronic contamination	Chemical toxicity	No	Interview	Joliet Army Munitions Plant
116	RCRA (R5)	Individuals (terrestrial and aquatic)	Acute and chronic effects; mortality, growth, and reproductive impairments	Chemical toxicity	No	Guidance	
117	RCRA (R5)	Populations (terrestrial and aquatic)	Acute and chronic effects; mortality, growth, and reproductive impairments	Chemical toxicity	No	Guidance	
118	RCRA (R5)	Vegetation (terrestrial)	Acute and chronic effects; absent or stressed vegetation	Chemical toxicity	No	Guidance	
119	RCRA (R5)	Water	Chronic effects of introduced species	Biological stressors	No	Guidance	Zebra mussel; this is ecosystem and welfare (water intake screen fouling)
120	RCRA (R5)	Water quality (state water quality standards)	Acute and chronic effects	Chemical toxicity	No	Interview	Permits, closures?
121	RCRA (R5)	Wetland community structure	Chronic effects	Chemical toxicity	No	Monitor	Modern Plating Corporation, monitoring wetland recovery

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
122	RCRA (R10)	Birds	Evidence of excess mortality in wildlife populations (e.g., bird kills)	Chemical toxicity	No	Guidance	
123	RCRA (R10)	Birds	Acute mortality	Chemical toxicity	No	Guidance	
124	RCRA (R10)	Community (aquatic)	Acute and chronic effects; use of AWQC as action levels	Chemical toxicity	No	Guidance	
126	RCRA (R10)	Endangered and threatened species (critical habitats of)		Chemical toxicity	No	Guidance	
127	RCRA (R10)	Fish	Acute mortality	Chemical toxicity	No	Guidance	
128	RCRA (R10)	Fish	Evidence of excess mortality in wildlife populations (e.g., fish kills)	Chemical toxicity	No	Guidance	
129	RCRA (R10)	Fish	Indirect biological effects (e.g., lowered pH or oxygen level which causes fish mortality)	Chemical toxicity	No	Guidance	
130	RCRA (R10)	Fish (salmon runs)		Chemical toxicity	No	Interview	Wyckoff, West Seattle
131	RCRA (R10)	Food chain/food web (terrestrial and aquatic organisms)	Bioaccumulation	Chemical toxicity	No	Interview	Sea Fab; Duamish River; EU rating
132	RCRA (R10)	Nutrient recycling (terrestrial)	Evidence of reductions in nutrient cycling, e.g., unusually thick leaf litter	Chemical toxicity	No	Guidance	
133	RCRA (R10)	Species (any "important" biological organisms; terrestrial and aquatic)		Chemical toxicity	No	Guidance	
134	RCRA (R10)	Vegetation (terrestrial)	Acute and chronic effects; absent or stressed vegetation	Chemical toxicity	No	Guidance	Developing action or cleanup levels

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
135	RCRA (R10)	Water quality (aquatic)	Acute and chronic effects; state or local water quality standards for designated uses used as action levels	Chemical toxicity	No	Guidance	
136	RCRA (R10)	Wildlife	Evidence of excess disease in wildlife populations	Chemical toxicity	No	Guidance	
137	SUPERFUND (HQ)	Coastal barriers		Chemical toxicity	Yes	HRS "sensitive environment"	
138	SUPERFUND (HQ)	Endangered species critical habitat	Acute and chronic effects	Chemical toxicity	Yes	HRS "sensitive environment"	RODs as reported in ECO Update: Ecological Assessment of Superfund Sites: An Overview
139	SUPERFUND (HQ)	Habitat (breeding areas for large or dense aggregations of terrestrial animals)		Chemical toxicity	Yes	HRS "sensitive environment"	
140	SUPERFUND (HQ)	Habitat (critical spawning and feeding areas, e.g., fish, shellfish, and anadromous fish)		Chemical toxicity	Yes	HRS "sensitive environment"	
141	SUPERFUND (HQ)	Habitat (unique communities)		Chemical toxicity	Yes	HRS "sensitive environment"	
142	SUPERFUND (HQ)	Marine sanctuaries		Chemical toxicity	Yes	HRS "sensitive environment"	
143	SUPERFUND (HQ)	National and State Wildlife Refuges		Chemical toxicity	Yes	HRS "sensitive environment"	NPL listings
144	SUPERFUND (HQ)	National Estuaries		Chemical toxicity	Yes	HRS "sensitive environment"	
145	SUPERFUND (HQ)	National Parks		Chemical toxicity	Yes	HRS "sensitive environment"	
146	SUPERFUND (HQ)	Wild and Scenic Rivers		Chemical toxicity	Yes	HRS "sensitive environment"	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
147	SUPERFUND (R3)	Birds (migratory waterfowl)	Potential adverse effects	Chemical toxicity	Yes	Decision	Wildcat Landfill, DE; ROD
148	SUPERFUND (R3)	Community structure (aquatic; e.g., species richness, presence of intolerant taxa)	Chronic effects	Chemical toxicity	No	Guidance	
149	SUPERFUND (R3)	Endangered and threatened species		Chemical toxicity	Yes	Interview	RI/FS
150	SUPERFUND (R3)	Organisms (aquatic; health of)	Chronic effects; increase of physical anomalies	Chemical toxicity	No	Guidance	
151	SUPERFUND (R3)	Populations (aquatic and terrestrial)	Chronic effects; adverse effects on growth, reproduction, and survival (i.e., mortality)	Chemical toxicity	No	Interview	
152	SUPERFUND (R3)	Species (aquatic and terrestrial)		Chemical toxicity	Yes	Decision	Wildcat Landfill, DE; ROD
153	SUPERFUND (R3)	Wetlands (and other natural habitats, communities, and ecosystems)	Chronic effects	Chemical toxicity	No	Interview	
154	SUPERFUND (R5)	Benthic organisms	Sediment contamination	Chemical toxicity	Yes	Interview	"Routinely used" to establish site-specific goals and remedial activities
155	SUPERFUND (R5)	Community (aquatic; use of AWQC)	Acute and chronic effects	Chemical toxicity	No	Guidance	
156	SUPERFUND (R5)	Fish	Acute mortality	Chemical toxicity	No	Guidance	
157	SUPERFUND (R5)	Vegetation (terrestrial)	Acute mortality (die-offs)	Chemical toxicity	No	Guidance	
158	SUPERFUND (R5)	Water quality (state water quality standards)	Acute and chronic effects	Chemical toxicity	No	Guidance	
159	SUPERFUND (R5)	Wildlife (terrestrial and aquatic; use of NOAELs and LOAELs)	Acute and chronic effects	Chemical toxicity	Yes	Interview	"Endpoints used routinely"

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
160	SUPERFUND (R9)	Benthic community structure	Acute and chronic effects	Chemical toxicity	No	Interview/plan	
161	SUPERFUND (R9)	Birds	Acute and chronic effects	Chemical toxicity	No	Interview	
162	SUPERFUND (R9)	Endangered species	Acute and chronic effects	Chemical toxicity	No	Interview	
163	SUPERFUND (R9)	Fisheries	Acute and chronic effects	Chemical toxicity	No	Interview	
164	SUPERFUND (R9)	Food chain/food web (aquatic and terrestrial)	Bioaccumulation	Chemical toxicity	No	Interview/plan	
165	SUPERFUND (R9)	Riparian habitat	Acute and chronic effects	Chemical toxicity	No	Interview	
166	SUPERFUND (R9)	Wildlife refuges	Acute and chronic effects	Chemical toxicity	No	Interview	
167	SUPERFUND (R10)	Benthic communities (surrogates for exposed and valued aquatic ecosystems)	Acute and chronic effects; use of AET for benthic invertebrate communities	Chemical toxicity	Yes	Decision	Commencement Bay: ROD-surrogate for integrity of benthic community
168	SUPERFUND (R10)	Birds (migratory birds and waterfowl)		Chemical toxicity	No	Interview	
169	SUPERFUND (R10)	Fish (health of fishery populations)	Chronic effects	Chemical toxicity	Yes	Decision	Commencement Bay ROD
170	SUPERFUND (R10)	Food chain/food web (wildlife)	Bioaccumulation	Chemical toxicity	Yes	Decision	Commencement Bay ROD
171	SUPERFUND (R10)	Species (self-sustaining commercially important species, e.g., waterfowl, salmon, trout, shellfish, herring)		Chemical toxicity	No	Interview	
172	SUPERFUND (R10)	Wetland acreage (for habitat value)		Chemical toxicity	No	Interview	
173	SUPERFUND (R10)	Wetland acreage (for use in filtering or binding pollutants)		Chemical toxicity	No	Interview	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
174	SUPERFUND (R10)	Wildlife (top of food chain feeders, e.g., hawk, falcon, eagle, osprey, great blue heron)		Chemical toxicity	No	Interview	
175	TOXICS (BIOTECH)	Endangered species	Acute and chronic effects; "unreasonable significant effects"	Chemical toxicity	Partial	Interview	Mansanto, Riziobin, and Cumarin: PMN review?
176	TOXICS (BIOTECH)	Wildlife (terrestrial)	Acute and chronic effects; "unreasonable significant effects"	Chemical toxicity	Partial	Interview	Mansanto, Riziobin, and Cumarin: PMN review?
177	TOXICS (ECAD)	Fish	Acute and chronic effects	Chemical toxicity	No	Risk assessment	
178	TOXICS (ECAD)	Mammals (aquatic)	Acute and chronic effects	Chemical toxicity	No	Risk assessment	
179	TOXICS (ECAD)	Waterfowl	Acute and chronic effects	Chemical toxicity	No	Risk assessment	
180	TOXICS (ECAD)	Wildlife (feeding on contaminated benthic organisms or fish)	Chronic effects	Chemical toxicity	No	Risk assessment	
181	TOXICS (ECAD)	Wildlife (terrestrial)	Acute and chronic effects	Chemical toxicity	No	Risk assessment	
182	TOXICS (PMN)	Algae	Acute or chronic effects; expected exceedance of an aquatic "concentration of concern"	Chemical toxicity	Yes	Interview	Surfactants, initial PMN decisions
183	TOXICS (PMN)	Fish	Acute or chronic effects; expected exceedance of an aquatic "concentration of concern"	Chemical toxicity	Yes	Interview	Surfactants, initial PMN decisions

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
184	TOXICS (PMN)	Invertebrates (aquatic; daphnia)	Acute or chronic effects; expected exceedance of an aquatic "concentration of concern"	Chemical toxicity	Yes	Interview	Surfactants, initial PMN decisions
185	WATER (CRITERIA)	Benthic organisms (sediment criteria)	Acute and chronic effects; sublethal effects	Chemical toxicity	Future	Interview	Sediment criteria still in draft form
186	WATER (CRITERIA)	Birds (fish-eating)	Acute and chronic effects	Chemical toxicity	Future	Interview	Development of AWQC
187	WATER (CRITERIA)	Community (aquatic)	Acute and chronic	Chemical toxicity	Yes	Interview	Any AWQC, development of National AWQC
188	WATER (CRITERIA)	Community (aquatic; biological integrity of)	Acute and chronic effects	Chemical toxicity	Future	Interview	Development of AWQC
189	WATER (CRITERIA)	Endangered species	Acute and chronic effects	Chemical toxicity	Yes	Interview	Development of AWQC
190	WATER (CRITERIA)	Invertebrates (aquatic)	Acute and chronic effects; sublethal effects	Chemical toxicity	Yes	Interview	Development of AWQC
191	WATER (CRITERIA)	Mammals (terrestrial, fish-eating)	Acute and chronic effects	Chemical toxicity	Future	Interview	Development of AWQC
192	WATER (CRITERIA)	Species (commercially important, including salmonids)	Acute and chronic effects	Chemical toxicity	Yes	Interview	Development of AWQC
193	WATER (CRITERIA)	Vegetation (aquatic plants)	Acute and chronic effects	Chemical toxicity	Yes	Interview	Development of AWQC
194	WATER (CRITERIA)	Wildlife (terrestrial)	Acute and chronic effects	Chemical toxicity	Future	Interview	Development of AWQC
195	WATER (NONPOINT)	Water	Not improving trends in chemical, biological, and physical integrity of waters	Chemical, physical, and biological stressors	Partial	Guidance	Approve/disapprove state management plans, award grants

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
196	WATER (NONPOINT)	Water	Not attaining of designated uses of surface waters	Chemical, physical, and biological stressors	Partial	Guidance	Approve/disapprove state management plans, award grants
197	WATER (NONPOINT)	Water	Pollutant loading into surface waters	Chemical, physical, and biological stressors	Partial	Guidance	Approve/disapprove state management plans, award grants
198	WATER (NONPOINT)	Water (high-quality waters)	Impairment of high-quality waters	Chemical, physical, and biological stressors	Partial	Guidance	Approve/disapprove state management plans, award grants
199	WATER (OCN DSCHRG)	Benthic organisms	Acute and chronic effects	Chemical and physical stressors	Yes	Interview/ guidance	
200	WATER (OCN DSCHRG)	Endangered and threatened species	Acute and chronic effects	Chemical and physical stressors	Yes	Interview/ guidance	
201	WATER (OCN DSCHRG)	Food chain/food web	Acute and chronic effects	Chemical and physical stressors	Yes	Interview/ guidance	
202	WATER (OCN DSCHRG)	Habitats (aquatic; natural, special, or sensitive)	Acute and chronic effects	Chemical and physical stressors	Yes	Interview/ guidance	
203	WATER (OCN DSCHRG)	Populations (balanced indigenous)	Acute and chronic effects	Chemical and physical stressors	Yes	Interview/ guidance	
204	WATER (OCN DSCHRG)	Species (water column)	Acute and chronic effects	Chemical and physical stressors	Yes	Interview/ guidance	
205	WATER (PERMITS, R9)	Amphibians or reptiles ("herps of special interest")		Chemical, physical, and biological stressors	Yes	Decision	Pamo Dam and Reservoir project permit review (vetoed permit)
206	WATER (PERMITS, R9)	Benthic organisms		Chemical, physical, and biological stressors	Yes	Decision	Docking facility in Humboldt County permit review
207	WATER (PERMITS, R9)	Birds ("of special interest")		Chemical, physical, and biological stressors	Yes	Decision	Pamo Dam and Reservoir project permit review (vetoed permit)
208	WATER (PERMITS, R9)	Endangered species		Chemical, physical, and biological stressors	Yes	Decision	Pamo Dam and Reservoir project permit review (vetoed permit)

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
209	WATER (PERMITS, R9)	Fish		Chemical, physical, and biological stressors	Yes	Decision	Docking facility in Humboldt County permit review
210	WATER (PERMITS, R9)	Fish	Effects of water temperature and flow on chinook population sizes	Physical stressors	Yes	Decision	COE dry dam flood protection project (Auburn, CA), EIS review
211	WATER (PERMITS, R9)	Habitat (upland, terrestrial)		Chemical, physical, and biological stressors	Yes	Decision	COE dry dam flood protection project (Auburn, CA), EIS review
212	WATER (PERMITS, R9)	Habitats (subtidal)		Chemical, physical, and biological stressors	Yes	Decision	Docking facility in Humboldt County permit review
213	WATER (PERMITS, R9)	Mammals (terrestrial)		Chemical, physical, and biological stressors	Yes	Decision	Pamo Dam and Reservoir project permit review (vetoed permit)
214	WATER (PERMITS, R9)	Riparian habitat		Chemical, physical, and biological stressors	Yes	Decision	COE dry dam flood protection project (Auburn, CA), EIS review
215	WATER (PERMITS, R9)	Vegetation (aquatic; water channel characteristics)		Chemical, physical, and biological stressors	Yes	Decision	COE dry dam flood protection project (Auburn, CA), EIS review
216	WATER (PERMITS, R9)	Vegetation (terrestrial and aquatic)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Pamo Dam and Reservoir project permit review (vetoed permit)
217	WATER (PERMITS, R9)	Water (open water)		Chemical, physical, and biological stressors	Yes	Decision	COE dry dam flood protection project (Auburn, CA), EIS review
218	WATER (PERMITS, R9)	Wetlands (as habitat)		Chemical, physical, and biological stressors	Yes	Decision	COE dry dam flood protection project (Auburn, CA), EIS review
219	WATER (QUALITY, R9)	Benthic invertebrates (aquatic)	Chronic effects	Chemical toxicity	Yes	Interview	
220	WATER (QUALITY, R9)	Endangered and threatened species		Chemical toxicity	No	Interview	San Francisco Bay Delta

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
221	WATER (QUALITY, R9)	Fish		Chemical toxicity (i.e., pesticides)	Yes	Interview	
222	WATER (QUALITY, R9)	Life (aquatic)	Acute and chronic effects	Physical stressors/ chemical toxicity	Yes	Interview	
223	WATER (QUALITY, R9)	Riparian habitat		Chemical, physical, and biological stressors	No	Interview	
224	WATER (QUALITY, R9)	Salinity		Chemical toxicity	No	Interview	
225	WATER (QUALITY, R9)	Water quality	Attainment of water quality no worse than 1975 CWA Amendments	Chemical toxicity	No	Interview	
226	WATER (QUALITY, R9)	Water quality	Attainment of water quality for designated uses, fish and wildlife	Chemical toxicity	Partial	Interview	
227	WATER (SF ESTUARY, R9)	Endangered and threatened species (survival and recovery of)		Chemical, physical, and biological stressors	No	Guidance	San Francisco Bay
228	WATER (SF ESTUARY, R9)	Estuarine biota (health and abundance of)		Chemical, physical, and biological stressors	No	Guidance	San Francisco Bay
229	WATER (SF ESTUARY, R9)	Estuarine habitats (health of)		Chemical, physical, and biological stressors	No	Guidance	San Francisco Bay
230	WATER (SF ESTUARY, R9)	Estuary	Chronic effects; toxic sediment accumulation	Chemical stressors	Yes	Guidance	
231	WATER (SF ESTUARY, R9)	Estuary	Reduction of pollutant loadings to estuary	Chemical, physical, and biological stressors	Yes	Guidance	
232	WATER (SF ESTUARY, R9)	Estuary (land use policies that encourage private sector protection)		Chemical, physical, and biological stressors	No	Guidance	
233	WATER (SF ESTUARY, R9)	Fish (natural production of anadromous fish)		Chemical, physical, and biological stressors	No	Guidance	
234	WATER (SF ESTUARY, R9)	Food chain/food web (terrestrial and aquatic)	Bioaccumulation	Chemical, physical, and biological stressors	Yes	Guidance	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
235	WATER (SF ESTUARY, R9)	Species (survival and recovery of terrestrial and aquatic species in decline)		Chemical, physical, and biological stressors	No	Guidance	San Francisco Bay
236	WATER (SF ESTUARY, R9)	Water	Unnecessary dredging activities	Chemical, physical, and biological stressors	Yes	Guidance	
237	WATER (SF ESTUARY, R9)	Water	Avoid/offset adverse impacts of dredging, flood control, development, etc.	Chemical, physical, and biological stressors	Yes	Guidance	
238	WATER (SF ESTUARY, R9)	Wetlands (as habitat; protection, restoration, and increase in)		Chemical, physical, and biological stressors	Yes	Guidance	San Francisco Bay
239	WATER (SLUDGE)	Soil organisms	Acute and chronic effects; effects on soil users, e.g., earthworms	Chemical toxicity	Partial	Decision	
240	WATER (SLUDGE)	Vegetation (crops)	Phytotoxicity	Chemical toxicity	Yes	Decision	Copper, chromium, nickel, and zinc level set
241	WATER (SLUDGE)	Wildlife (terrestrial predators, e.g., shrews)	Acute and chronic effects	Chemical toxicity	Partial	Decision	
242	WATER (SLUDGE)	Wildlife (terrestrial; plant-eating wildlife and domestic animals)	Acute and chronic effects	Chemical toxicity	Partial	Decision	Molybdenum level set
243	WATER (SLUDGE)	Wildlife (terrestrial; sludge-eating wildlife and domestic animals)	Acute and chronic effects	Chemical toxicity	Partial	Decision	Selenium level set
244	WATER (WETLANDS)	Birds (wading bird rookeries)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview/ guidance	
245	WATER (WETLANDS)	Endangered species	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview/ guidance	
246	WATER (WETLANDS)	Fish (high-quality trout streams)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview/ guidance	
247	WATER (WETLANDS)	Wetlands (type)	Loss of unique or scarce wetland types	Chemical, physical, and biological stressors	Yes	Interview/ guidance	

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
248	WATER (WETLANDS)	Wetlands (wetland functions)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview/ guidance	
249	WATER (WETLANDS)	Wetlands (wetland organisms)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview/ guidance	
250	WATER (WETLANDS, R9)	Endangered and threatened species	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview	Santa Margarita case, Grant awarded
251	WATER (WETLANDS, R9)	Fish (salmon runs)	Acute and chronic effects	Chemical, physical, and biological stressors	No	Interview	Grant awarded
252	WATER (WETLANDS, R9)	Habitats (natural; uncommon; terrestrial and aquatic)	Acute and chronic effects	Chemical, physical, and biological stressors	No	Interview	Grants awarded
253	WATER (WETLANDS, R9)	Wetlands (maintenance and increase in wetland functions and values)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Interview	Grants awarded
254	WATER (WETLANDS, R10)	Birds (nesting habitat for tundra swans and other migratory waterfowl)		Chemical, physical, and biological stressors	Yes	Decision	Nesting habitat of tundra swans and other migratory waterfowl, proposed determination to withdraw Kuparik River Unit from use as disposal site
255	WATER (WETLANDS, R10)	Birds (tundra swans)		Chemical, physical, and biological stressors	Yes	Decision	Tundra swans, proposed determination to withdraw Kuparik River Unit from use as disposal site
256	WATER (WETLANDS, R10)	Deltas (restoration of)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	Skokomish River Delta Project, aiding states/ local governments/tribes in developing wetland protection projects
257	WATER (WETLANDS, R10)	Endangered and threatened species		Chemical, physical, and biological stressors	Yes	Decision	Kuparuk River Unit
258	WATER (WETLANDS, R10)	Endangered and threatened species (protect current habitats of)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	West Eugene Wetlands Study Area, aiding states/ local governments/tribes in developing wetland protection projects

Table D-7. All Ecological Concerns Identified by the Survey (continued)

#	Program Area	Valued Ecological System or Component	Concern(s)	Stressor(s) of Concern	Action/ Decision*	Source	Notes
259	WATER (WETLANDS, R10)	Endangered and threatened species (protect current populations of)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	West Eugene Wetlands Study Area, aiding states/ local governments/tribes in developing wetland protection projects
260	WATER (WETLANDS, R10)	Habitats (aquatic; e.g., juvenile salmon nurseries, eel grass beds)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	West Eugene Wetlands Study Area, aiding states/ local governments/tribes in developing wetland protection projects
261	WATER (WETLANDS, R10)	Habitats (migratory bird flyways)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	West Eugene Wetlands Study Area, aiding states/ local governments/tribes in developing wetland protection projects
262	WATER (WETLANDS, R10)	Vegetation (i.e., deep pendent grass, a food source for waterfowl)	Potential damage	Chemical, physical, and biological stressors	Yes	Decision	Deep pendent grass (food source waterfowl), proposed determination to withdraw Kuparik River Unit from use as disposal site
263	WATER (WETLANDS, R10)	Wetlands	Acute and chronic effects; loss of acreage	Chemical, physical, and biological stressors	Yes	Decision	Skokomish River Delta Project, aiding states/ local governments/tribes in developing wetland protection projects
264	WATER (WETLANDS, R10)	Wetlands (protect a variety of)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	West Eugene Wetlands Study Area, aiding states/ local governments/tribes in developing wetland protection projects
265	WATER (WETLANDS, R10)	Wetlands (protection of an interconnected system of wetlands within a sustainable, ecologically sound system)	Acute and chronic effects	Chemical, physical, and biological stressors	Yes	Decision	West Eugene Wetlands Study Area, aiding states/ local governments/tribes in developing wetland protection projects

* Codes for Action/Decision column are:

Yes = the ecological concern was considered in an EPA decision or action

No = the ecological concern is not documented as being considered in an EPA decision or action

Partial = other factors such as human health or welfare were actually the dominating concerns

Future = an ecological concern that may be considered in the future

Appendix E

Additional Comments From Office Interviews

E.1 Policy Guidance

Other individuals within EPA also seek policy guidance on a wide array of subjects, including:

- Protecting terrestrial ecosystems, habitats, biodiversity, and important ecological values and functions.
- Defining national-level goals, public community-level goals, EPA's role versus that of other agencies involved in ecological protection, and the Regions' role in protecting ecological resources.
- Sharing information with states and nongovernment organizations (NGOs), applying information not developed by EPA, and linking up with ecosystem concepts used by other agencies or NGOs.
- Assessing cumulative impacts, evaluating ecosystem-level aspects of environmental problems, incorporating public input in setting pollution limits or criteria, and quantifying the values or benefits of ecological resources.
- Incorporating concepts such as forest fragmentation and acid deposition in Agency assessments.

At present, senior management does not have a system to compare various ecological effects, and no standard national methodology exists to define "an effect of ecological concern." One program area did state, however, that its managers tend to rank risks to fish higher than invertebrates, and invertebrates higher than algae, although, from an ecological point of view, algae (primary energy producers) and invertebrates (a vital food source for fish) may be more important to the maintenance of the aquatic system. This program area also stated that direct effects (e.g., mortality caused by exposure to toxic chemicals) are considered rather than indirect effects (e.g., mortality caused by starvation as a result of a contaminated food source) because they are easier to document.

Some individuals commented that the significance of exceeding an ecological criterion was unclear. Others stated that the Agency-wide significance of ecological decisions remain vague (i.e., Can ecological protection statements made by the Administrator for one program office pertain to other program offices as well?).

Some individuals state that the significance of ecological impacts needs to be more clearly articulated and emphasized in EPA decisions. One program area stated that the public often does not perceive undeveloped habitats, such as a wetland, as valuable, and it is difficult to convince the public otherwise. Some individuals expressed the view that economic and environmental goals are still perceived widely by the general public as incompatible concepts, and that the stringency of cleanup levels for ecological concerns often receives challenges from the regulated community. Others stated that challenges also come from the public, especially when a regulatory action may have an adverse economic impact, such as a loss of jobs or reduced property rights. Another individual noted that economic studies that consider ecological resources are often controversial; for example, one ongoing debate involves how to value endangered species in economic terms.

E.2 Technical Guidance and Support

Program areas comment that guidance is needed on how to carry out habitat restoration and mitigation, determine habitat "replacement ratios," and delineate wetland boundaries. Individuals also recommend that a credible scientific link between toxicity tests (which typically evaluate individual lethalties) and risks to higher levels of biological organization (i.e., populations, communities, and ecosystems) be established. Another program area states it does not know how to predict population level effects and will not ask for guidance until it is clear whether the program needs to predict or demonstrate population level effects before making a regulatory decision.

Several programs express difficulty in quantifying concentrations of and responses to chemicals actually taken up by plants and animals. Another difficulty is determining the relative contributions of all stressors (e.g., chemical, physical, and biological) when deciding on project areas. Other unresolved technical issues include choosing reference areas (e.g., an area with desired environmental quality conditions for use in regulatory comparisons with other similar, but contaminated areas); providing scientific justifications for assessment endpoints used in risk assessments; relying on quantitative analysis (e.g., attempting to explain dynamic

events using simplistic, quantitative expressions); and addressing incremental risks, contaminant mixtures, and residue effects.¹

Other recommendations for technical guidance and support:

- Site-specific protocols that can be used and compared among different types of sites.
- More research on the ecological effects of air pollution.
- Peer-reviewed standard models for conducting ecological risk assessments.
- Standardized indicators (measurement endpoints) of ecological risk.
- More terrestrial toxicity test methods.
- Good chronic bioassay tests for benthic organisms.
- Economic methods that consider the sustainability of ecological resources.
- Better exposure models.
- Ecological risk assessment procedures for analyzing stratospheric ozone depletion, global climate change, losses in biodiversity, and cumulative impacts.

¹ For example, the effects of a chemical residue in the tissues of an organism (such as a chinook salmon) on one of its predators (such as a black bear or bald eagle).

E.3 Information and Data

Various program areas report that more information is needed on stressors, terrestrial risks, the effects of certain chemicals or mixtures on plants and animals, actual incidents of ecological harm, the descriptive and quantitative aspects of wetlands, and data useful for projects such as present and future geographic initiatives (e.g., Great Lakes and San Francisco Bay initiatives). One individual states that appropriate data are not generally available for understanding the fate and transport of ground-water contaminants that may discharge to the surface and pose a risk to ecological resources. Issues about access to existing ecological databases, their usefulness to programs, and how they should be maintained were not brought up by the program areas interviewed. The survey failed to pick up these important issues, which in the authors' opinion should also be addressed by EPA. Many existing EPA sources of ecological information (some of which are already used by program offices) are described in the Information Systems Inventory (U.S. EPA, 1994).

E.4 References

U.S. EPA. 1994. Information Systems Inventory (ISI). EPA/220/B-94/001 (NTIS PB 94-107711). Washington, DC: Office of Administration and Resources Management. (January).

Appendix F
Individual Office Summaries

**Acid Rain Division, Office of Atmospheric Programs
Office of Air and Radiation
AIR (ACID DEP)**

Background

Decisions

The Acid Rain Program was established to reduce emissions of sulfur dioxide and nitrogen oxides. The program is driven by environmental concerns and employs innovative, market-based approaches, as well as traditional strategies (U.S. EPA, 1992).

Statutory Authority

Title IV of the 1990 Clean Air Act Amendments (CAAA) addresses requirements concerning the reduction of sulfur dioxide and nitrogen oxide emissions. Section 812 of the amendments mandates the evaluation of CAA control program costs, benefits, and effectiveness, including provisions in Title IV. Title IX requires data collection, monitoring, analysis, and modeling to more fully understand and track environmental indicators.

Ecological Considerations

Ecological Values To Be Protected

Section 401(a)(1) of Title IV of the CAA states: "The presence of acidic compounds and their precursors in the atmosphere and in deposition from the atmosphere represents a threat to natural resources, ecosystems materials, visibility and public health."

Section 404 requires that the Administrator report to Congress on the feasibility and effectiveness of an acid deposition standard or standards to protect sensitive and critically sensitive aquatic and terrestrial resources.

Specific Ecological Concerns or Assessment Endpoints

Research has shown unequivocally that adverse effects on U.S. aquatic ecosystems have resulted from acid deposition (Helme and Neme, 1991). Although studies on forest damage do not show widespread adverse effects, damage to high-elevation stands has been demonstrated (Helme and Neme, 1991) as have such effects on soils as nutrient depletion. Acid deposition also has been shown to cause visibility degradation. Although the Acid Rain Program has given particular emphasis to

environmental impacts including effects on aquatic systems and visibility endpoints, high-elevation forests and forest soils also are considered. Specific aquatic concerns include:

- Effects on water chemistry
- Effects on species diversity
- Effects on sportfish
- Effects on aquatic species in general
- Effects on aquatic resources in general

Air quality-related values are protected in Class I areas—where acid deposition might have a role—and often are ecological in nature. These values are very specific to the Class I area. A few examples of ecological concerns include (Fox et al., 1989):

- High-quality waters that support a highly diverse fishery.
- Bird populations.
- Natural diversity.
- "Coniferous and mixed coniferous forests that provide the critical habitat for one of the last remaining and viable eastern timber wolf populations in the continental United States."

References and Other Sources of Information

- Claussen, E. 1991. Acid rain: The strategy. EPA Journal 17(1):21-23.
- Fox, D.G., A.M. Bartuska, J.G. Byrne, E. Cowling, R. Fisher, G.E. Likens, S.E. Lindberg, R.A. Linthurst, J. Messer, and D.S. Nichols. 1989. A screening procedure to evaluate air pollution effects on Class I Wilderness Areas. General Technical Report RM-168. U.S. Department of Agriculture, Forest Service.
- Helme, N., and C. Neme. 1991. Acid rain: The problem. EPA Journal 17(1):18-20.
- U.S. EPA. 1992. Acid rain program: Overview. EPA/430/F-92/019. Office of Air and Radiation.

Office of Air Quality and Planning Standards
Office of Air and Radiation
AIR (OAQPS)

Background

Decisions

Decisions made by this Office involve identifying air pollutants and issuing emissions standards and ambient air quality criteria and standards. Although public health is the primary concern, public welfare, which includes aspects of environmental quality, is a secondary concern. Specific decisions that the Office of Air Quality and Planning Standards (OAQPS) can base on ecological risk include those regarding:

- Listing and regulation of hazardous air pollutants or other pollutants that endanger public welfare.
- Permits for new emissions sources (such decisions can be delegated to the states and subject to OAQPS review and petition control).
- Secondary National Ambient Air Quality Standards (NAAQS), including consideration of ecosystem effects.

Statutory Authority

Sections 108 and 109 of the Clean Air Act (CAA) require that EPA set primary air quality standards to protect public health and secondary air quality standards to protect public welfare. Section 111 provides for regulation of stationary sources for noncriteria pollutants and pollutants not regulated under other provisions; Section 112 requires the listing of hazardous air pollutants based on both human health and adverse environmental effects. Part C of the act charges federal land managers with the responsibility of protecting the air-quality-related values (e.g., bird populations, forest health) of Class I areas (i.e., National Parks existing as of August 7, 1977, that are larger than 6,000 acres, or other areas that have been designated by states as Class I areas).

Ecological Considerations

Ecological Values To Be Protected

The CAA requires EPA to:

- “Protect and enhance the quality of the Nation’s air resources so as to promote the public health and welfare” (§101[b][1]).

- Regulate hazardous air pollutants that present “adverse environmental effects” (§112).
- “Preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value” (§160[2]) and “prevent significant deterioration of air quality in each” (§161).
- Welfare includes “effects on soils, water, crops, vegetation, animals, wildlife” (§302[h]).

Under the CAA, the “Administrator may assess the risks to ecosystems from exposure to criteria air pollutants” (§108[g]), and then set secondary ambient air quality standards at levels that “protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air” (§109[b][2]).

Also under the CAA, the Administrator is charged with a number of specific responsibilities related to ecological values:

- The Administrator must add to the list of hazardous air pollutants those that “present, or may present...adverse environmental effects whether through ambient concentrations, bioaccumulation, deposition, or otherwise...” (§112[b][2]). Adverse environmental effects are defined as “any significant and widespread adverse effect, which may reasonably be anticipated, to wildlife, aquatic life, or other natural resources, including adverse impacts on populations of endangered or threatened species or significant degradation of environmental quality over broad areas” (§112[a][7]).
- “The Administrator, in cooperation with the Under Secretary of Commerce for Oceans and Atmosphere, shall conduct a program to identify and assess the extent of atmospheric deposition of hazardous air pollutants (and in the discretion of the Administrator, other air pollutants) to the Great Lakes, the Chesapeake Bay, Lake Champlain and coastal waters” (§112[m]).
- The Administrator must add to the list of Class I substances any chemicals that cause or contribute “significantly to harmful effects on the stratospheric ozone layer” (i.e., chemicals for which “ozone-depletion potential” is greater than 0.2), and must publish the

“global warming potential” of each listed Class I substance (§603).

Specific Ecological Concerns or Assessment Endpoints

Ecological endpoints have been considered to varying degrees in OAQPS decisions (Table F-1). Historically, ecological concerns alone have not always provided a sufficient basis for decisions. Notably, in 1971 EPA promulgated a secondary annual standard for sulfur dioxide due to its effects on white pines, aspen, and crops. The standard was remanded and, with insufficient

information to overcome the court’s concerns, the standard was revoked. In contrast, permitting decisions for new emission sources based solely on ecological concerns have held firm.

References and Other Sources of Information

Clean Air Act. 1963. 42 U.S.C. §7401 et seq.
 National Park Service (NPS). 1990. Technical support document regarding adverse impact determination for Shenandoah National Park (September).

Table F-1. Examples of OAQPS Decisions That Considered Adverse Ecological Effects

Pollutant	Was Decision Based on Ecological Risk?	Ecological Effects Considered During Decision-Making Process
Aluminum reduction plant emissions	Partially (both welfare and ecological values considered)	Fluorosis effects (including effects on both cattle and vegetation)
Sulfuric acid production unit emissions	Partially (both welfare and ecological values considered)	Physical damage to plants (e.g., foliar damage, tree yields); forest ecosystem health (inferred from lichen chronic exposure as measurement endpoint used to set annual sulfur dioxide standard)
Sulfur dioxide	Secondary annual standard set in 1971, but later, 3-hour standard retained.	Effects on vegetation; white pines, aspen, and crops
Sulfur, nitrogen, and ozone emissions	Yes, prevention of significant deterioration (PSD) decision; changed emission levels (authority was delegated to states, but EPA had review and petition control)	Ecological effects at Shenandoah National Park (including hastening “the acidification of sensitive streams within the park with resulting effects on aquatic life” and threatening “sensitive park vegetation”) (NPS, 1990)
Sulfuric acid deposition	Yes, PSD decision; permit for Half Moon Power Plant in New York initially denied; later approved with offsets required for new sources	Effects on aquatic ecosystems in New Hampshire and Virginia

Stratosphere Protection Division, Analysis and Review Branch
Office of Air and Radiation
AIR (STRAT)

Background

Decisions

The Analysis and Review Branch (ARB) is currently developing a program for evaluating substitutes for ozone-depleting substances as part of the Significant New Alternatives Policy (SNAP) Program. Decisions are currently proposed for approximately 300 substitutes. Although when deciding on which substitutes represent the best alternatives ARB considers ecological risk, it is not considered a major issue (U.S. EPA, 1992b). Ecological risk assessments play a minor role in ARB decisions because (1) there is currently a lack of established ecological risk assessment methods with respect to substitutes analysis; and (2) ARB is limited by the time constraint imposed by the phaseout dates, leaving little time to develop such methods (U.S. EPA, 1992b). In the future, ARB hopes to incorporate more ecological analysis into its decision-making process (U.S. EPA, 1992b). In their view, the ability to do so depends in large part on the progress of joint Office of Research and Development work studying the fate and transport of ozone-depleting substances.

Statutory Authority

The overall policy of the SNAP Program is defined in the Clean Air Act Amendments (CAAA) of 1990: "To the maximum extent practicable, class I and class II [ozone-depleting] substances shall be replaced by chemicals, product substitutes, or alternative manufacturing processes that reduce overall risks to human health and the environment" (§612[a]). EPA is also charged with the responsibility of promulgating rules (within 2 years of the enactment of the Act of 1990) "providing that it shall be unlawful to replace any class I or class II substance with any substitute substance which the Administrator determines may present adverse effects to human health or the environment" (§612[c]).

Ecological Considerations

Ecological Values To Be Protected

The safe alternatives policy is a very general statement, the goal of which is to "reduce overall risks to...the environment" (CAAA §612[a]). This clause is broadly interpreted by EPA to include ecological risks (U.S. EPA, 1992b).

Specific Ecological Concerns or Assessment Endpoints

ARB studies various alternatives to determine which ones are the safest in the environment. Specifically, ARB has conducted aquatic toxicity and exposure analysis in its evaluation of substitutes for aqueous and semi-aqueous cleaners (U.S. EPA, 1992b). Thus, one ecological assessment endpoint that can be inferred is the protection of aquatic life by using concentrations of concern derived by the Office of Pollution Prevention and Toxics (OPPT) (U.S. EPA, 1992c).

References and Other Sources of Information

- U.S. EPA. 1992a. Briefing on EPA's Significant New Alternatives Policy Program. Prepared for the International CFC and Halon Alternatives Conference (notice). Fed. Reg.
- U.S. EPA. 1992b. Report on characterization of risk from the use of substitutes for Class I ozone-depleting substances: Solvent cleaning (draft).
- U.S. EPA. 1992c. Transcript of ecological risk management survey: 1992 interview with Substitutes Analysis and Review Branch, Stratospheric Ozone Protection Division, Office of Air and Radiation.

Region 5
Air Toxics and Radiation Branch, Air Division
AIR TOXICS (R5)

Background

Decisions

Region 5 Air Toxics and Radiation Branch (Air Toxics, Region 5) is involved in the following activities and studies that involve the incorporation of ecological information:

- The Great Waters Study (Report to Congress).
- Ecological assessments of the impact of RCRA-permitted incinerators on bald eagles.
- Outreach/education campaigns on phaseout of ozone-depleting substances (ODSs) and labeling measures (ecological effects are a very minor consideration in this area).
- Identification of sources and categories of critical pollutants.
- Water Quality Initiative (involves the determination of the extent of air deposition; includes a mass balance study).

Many of these activities play an important role in regulatory development.

Statutory Authority

Air Toxics, Region 5, has statutory authority relating to Section 112 of the 1990 Clean Air Act Amendments (CAAA) for air toxics, and Title VI of the CAAA for ozone regulations. Under CAAA Section 112, the first Great Waters Report to Congress was due in 1993; in 1995, additional regulations will be established on ecological grounds based on the first report. Although Air Toxics, Region 5, has a global warming program, its statutory and regulatory basis has not yet been established.

At present, Air Toxics, Region 5, believes it lacks the statutory authority to take regulatory action based on ecological concerns because criteria pollutant regulations are human health-oriented.

Ecological Considerations

Ecological Values To Be Protected

While Title VI of the CAAA protects human health and the environment, another goal of Air Toxics, Region 5, is to protect aquatic systems from impacts of air deposition. (See "Ecological Values To Be Protected" in the Headquarters Office of Air Quality Planning and Standards summary.)

Specific Ecological Concerns or Assessment Endpoints

Ecological concerns that can be inferred from the Great Lakes Regional Air Toxics Emission Inventory include (U.S. EPA, 1992):

- Toxicity to aquatic life
- Bioaccumulative potential

Emission inventories are of fundamental importance for the success of a regulatory program that seeks to protect the Great Lakes ecosystem (U.S. EPA, 1992).

The Great Waters Study evaluates several ecological endpoints:

- Bioaccumulation in the food web.
- Effects of persistent toxic substances on fish, birds, mammals, and Great Waters ecosystems.
- Reproductive effects.
- Eutrophication.

An ecological endpoint evaluated in the ODS phaseout outreach program was the effects of air toxics on marine phytoplankton.

References and Other Sources of Information

U.S. EPA. 1992. States' air regulatory agencies efforts for Great Lakes protection (May).

Great Lakes National Program Office GLNPO (R5)

Background

Decisions

The main responsibilities of the Great Lakes National Program Office (GLNPO) include data collection, research and monitoring, surveillance, habitat restoration, sediment assessment, nonremedial action plans, lakewide management plans (LaMPs), and nonregulatory programs. Ecological concerns are important considerations in regard to these responsibilities.

Statutory Authority

The Great Lakes Water Quality Agreement (GLWQA) and the Critical Programs Act provide statutory authority for GLNPO.

Ecological Considerations

Ecological Values To Be Protected

The GLWQA establishes the following overall goal: “restoring the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem” to “achieve healthy populations of plant, fish, and wildlife populations” (COE et al., 1991).

Specific Ecological Concerns or Assessment Endpoints

Ecological concerns include (COE et al., 1991):

- Reduction of “the level of toxic substances in the Great Lakes and surrounding habitat, with an emphasis on

persistent toxic substances, so that all organisms are adequately protected and, over time, these substances will be virtually eliminated from the Great Lakes Ecosystem.”

- Protection and restoration of “habitats vital for the support of healthy and diverse communities of plants, fish, and wildlife, with an emphasis on wetland habitats and those habitats needed by endangered and threatened species.”
- Restoration and maintenance of “stable, diverse, and self-sustaining populations of fish, other aquatic life, wildlife and plants, to the Great Lakes Basin Ecosystem.”

The lakewide management planning process for Lake Michigan is “designed to reduce loadings of toxic pollutants...to levels where the living resources of Lake Michigan are no longer imperiled” (U.S. EPA, 1992). GLNPO provides funding for habitat restoration projects.

References and Other Sources of Information

Habitat restoration project abstracts.

U.S. Army Corps of Engineers (COE), U.S. Coast Guard, U.S. EPA, et al. 1991. Protecting the Great Lakes: Our environmental goals and how we plan to achieve them.

U.S. EPA. 1992. Lake Michigan lakewide management plan (draft) (January 1).

Office of Federal Activities NEPA (OFA)

Background

Decisions

The Office of Federal Activities (OFA) works closely with other federal agencies when they make decisions that might affect the environment. Within EPA, OFA is responsible generally for reviewing the environmental impacts of major federal initiatives, including Agency-proposed legislation, regulations, and major actions (e.g., those requiring environmental impact statements [EISs] under the National Environmental Policy Act [NEPA]). OFA reviews and rates EISs in terms of environmental acceptability and adequacy of documentation. More generally, OFA decisions involve:

- Deciding what to review.
- Rating each reviewed document.
- Determining the content of a comment letter.
- Deciding whether to refer unacceptable documents to the Council on Environmental Quality (CEQ).

OFA also has responsibility for overseeing EPA's own compliance with NEPA and related statutes (e.g., the Endangered Species Act), and provides expertise on international issues concerning environmental impact assessment.

Statutory Authority

EPA has general statutory authority under NEPA and the CEQ regulations (40 CFR Parts 1500-1508). The purposes of NEPA include: "To declare a national policy which will encourage. . .harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere. . .; [and] to enrich the understanding of the ecological systems and natural resources important to the Nation" (NEPA §2). EPA has specific authority and responsibility under Section 309 of the Clean Air Act to conduct reviews and to comment in writing on proposed federal legislation and regulations, as well as on newly authorized major actions.

Ecological Considerations

Ecological Values To Be Protected

NEPA (§101[b]) states that it is the goal of the Nation to:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.
- 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.
- Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Specific Ecological Concerns or Assessment Endpoints

Reviews performed by OFA are largely qualitative in nature. While OFA has not established its own thresholds, it uses those of other program offices and federal agencies on a case-by-case basis. OFA uses best judgment in considering the size, value, and uniqueness of impacted areas; total loss; proportional loss; and considerations of loss relative to what is available. OFA has more specific measures for decisions regarding terrestrial biota, including productivity, connectivity, and overall importance to other wildlife.

OFA considers the following ecological risk endpoints when rating the environmental impact of an action (U.S. EPA, 1984):

- Violation of "a national environmental standard."
- The "potential for significant environmental degradation."
- The "significant environmental impacts."
- The "severity, duration, or geographical scope of the impacts."
- A "threat to national environmental resources or to environmental policies."

Examples of specific ecological concerns that have been used in OFA decisions are provided in Table F-2.

References and Other Sources of Information

Sanderson, R.E. 1988. EPA and NEPA: Cases in point. EPA Journal. January/February: 25-30.

U.S. EPA. 1991. Perspective on environmental risk: Nexus between EPA and Science Advisory Board's recommendations on reducing risk. Office of Enforcement, Office of Federal Activities.

U.S. EPA. 1984. Policy and procedures for the review of federal actions impacting the environment. Office of External Affairs, Office of Federal Activities.

Table F-2. Examples of OFA Decisions Based on Ecological Risk

Project	Review Date; Decision Type	Assessment Endpoints Considered in Decision
Department of Agriculture (DOA) Animal and Plant Health Inspection Service (APHIS) grasshopper control project (spraying with 3 pesticides)	1986; environmentally unsatisfactory (EU)	(1) Potential for damaging surface waters; (2) threatening wildlife (especially endangered species); and (3) contaminating cattle meat (Sanderson, 1988)
Soil Conservation Service, DOA Delmarva drainage improvement project	1987; EU (Region 3)	Losses to riparian habitats and wetlands associated with Chesapeake Bay tributaries (Sanderson, 1988)
Tennessee Valley Authority barge terminals project	1992; EU/2 environmentally unsatisfactory, insufficient information (Region 4)	(1) Potential water quality and wetland impacts; (2) loss of habitat and biodiversity; and (3) cumulative impacts
Appalachian Corridor H	1993; EU2 (Region 3)	Impacts to remote habitats, wetlands, and streams

Region 3 NEPA, Environmental Services Division NEPA (R3)

Background

Decisions

Like the Office of Federal Activities, the Region 3 Environmental Services Division performs National Environmental Policy Act (NEPA) reviews on environmental impact statements (EISs). The Division also participates in strategic planning, in an environmental indicators development project, and in a terrestrial ecosystem initiative.

Statutory Authority

EPA has general statutory authority under NEPA and the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1,500-1,508). The purposes of NEPA include: "To declare a national policy which will encourage... harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere. . . ; [and] to enrich the understanding of the ecological systems and natural resources important to the Nation" [NEPA §2].

EPA also has authority under the Pollution Prevention Act (PPA) "to promote the use of source reduction techniques by businesses" (e.g., by giving grants to states) (PPA §6605[a]).

Ecological Considerations

Ecological Values To Be Protected

The Region 3 Environmental Services Division protects natural resources and the environment in general. Specific ecological values are presented in the Headquarters Office of Federal Activities summary.

Specific Ecological Concerns or Assessment Endpoints

The following ecological concerns are considered in rating the environmental impact of an action:

- Violation of "a national environmental standard" (U.S. EPA, 1984).
- "Potential for significant environmental degradation" (U.S. EPA, 1984).
- "Significant environmental impacts" (U.S. EPA, 1984).

- "The severity, duration, or geographical scope of the impacts" (U.S. EPA, 1984).
- A "threat to national environmental resources or to environmental policies" (U.S. EPA, 1984).
- "Potential impacts to valued natural resources."

EPA tends to focus on water and air quality concerns and pollution prevention concerns. The Fish and Wildlife Service is responsible for protecting endangered and threatened species and the National Park Service protects cultural sites. Historically, protection of air and water quality and wetlands has been the driving concern in Region 3. More recent concerns include protection of terrestrial ecosystems and neotropical migratory birds.

Examples of specific ecological assessment endpoints that have been used in Region 3 EIS rating decisions are given in Table F-3.

References and Other Sources of Information

- Erickson, E.B. 1990. Letter from the Regional Administrator, U.S. EPA Region 3, on the Southeastern Expressway, Chesapeake/Virginia Beach.
- Esher, D. 1991. Letter from the Chief, Environmental Planning and Assessment Section, U.S. EPA, on the Woodrow Wilson Bridge Improvement Study, Draft Environmental Impact Statement.
- Laskowski, S.L. 1993. Letter from the Acting Regional Administrator, U.S. EPA Region 3, on the Appalachian Corridor H Highway Project.
- Pepino, R.V. 1992. Letter from the Chief, Environmental Assessment Branch, U.S. EPA, on the Draft Environmental Impact Statement/Section 404 Permit Application, Lackawanna Valley Industrial Highway, Lackawanna County, Pennsylvania.
- Sanderson, R.E. 1988. EPA and NEPA: Cases in point. EPA Journal. January/February:25-30.
- U.S. EPA. 1992. Transcript of ecological risk management survey: Interview with personnel from Region 3 Environmental Services Division (March 10).
- U.S. EPA. 1984. Policy and procedures for the review of federal actions impacting the environment. Office of External Affairs, Office of Federal Activities.

Table F-3. Examples of Region 3 NEPA Decisions Based on Ecological Risk

Project	Decision Type	Ecological Concerns or Assessment Endpoints Considered in Decision
Southeastern Expressway, Virginia	Environmentally unsatisfactory (EU)	Potential impacts to wetlands and water supply, and secondary impacts such as promoting development in a sensitive area (Erickson, 1990)
Appalachian Corridor H: proposed 110-mile highway, West Virginia	EU	Potential impacts to streams, National Forests, and other natural resources (Laskowski, 1993)
Lackawanna Valley industrial highway project	Lack of objections (LO)	Extensive information and data were provided on environmental features, allowing for avoidance of sensitive resources (Pepino, 1992)
Woodrow Wilson Bridge improvement project	Environmental objections (EO); environmental concerns (EC)	Adverse impacts to aquatic ecosystems; potential impacts to wetlands, air quality, and ground water; impacts to "excellent habitat for ducks and other waterfowl" (Esher, 1991)
Soil Conservation Service, Department of Agriculture, Delmarva drainage improvement project	1987, EU (Region 3)	Losses to riparian habitats and wetlands associated with Chesapeake Bay tributaries (Sanderson, 1988)
Appalachian Corridor H	1993, EU-2 (Region 3)	Impacts to remote habitats, wetlands, and streams

Region 5 NEPA, Planning Assessment Branch NEPA (R5)

Background

Decisions

The Region 5 Planning Assessment Branch incorporates ecological concerns in National Environmental Policy Act (NEPA) reviews, strategic planning, Indian programs, and comparative risk analyses.

Statutory Authority

EPA has general statutory authority under NEPA and the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508). The purposes of NEPA include: "To declare a national policy which will encourage. . . harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere. . . ; [and] to enrich the understanding of the ecological systems and natural resources important to the Nation" (NEPA §2). EPA has specific authority and responsibility under Section 309 of the Clean Air Act to conduct reviews and to comment in writing on newly authorized major actions.

Ecological Considerations

Ecological Values To Be Protected

The Region 5 NEPA program protects natural resources and the environment in general. Specific ecological

values are presented in the Headquarters Office of Federal Activities summary.

Specific Ecological Concerns or Assessment Endpoints

Saving rare ecosystems and "[h]igh quality habitats" (Schneider, 1992) are ecological endpoints of the Region 5 NEPA program. Examples of specific ecological assessment endpoints that have been used in Region 5 NEPA decisions are provided in Table F-4.

References and Other Sources of Information

Franz, W.D. 1990a. November 30, 1990, letter from the Chief, Environmental Review Branch, U.S. EPA, to Duane D. Dick regarding the Sunken Camp Area of the Chequamegon National Forest.

Franz, W.D. 1990b. October 2, 1990, letter from the Chief, Environmental Review Branch, Planning and Management Division, U.S. EPA, to Dan Pritchard regarding the DEIS for the proposed improvement of Wisconsin State Highway 54.

Schneider, J.P. 1992. High quality habitat protection by the U.S. Environmental Protection Agency: Proposal. Geographic Information Systems Management Office.

Table F-4. Examples of Region 5 NEPA Decisions Based on Ecological Concerns

Project	Ecological Concerns Considered in Decision
Changed proposed highway route in Wisconsin	Protection of a high-quality remnant prairie with valuable plants (habitat of the state-classified "watch" species, the Karner Blue butterfly) (Franz, 1990b)
Army set aside 4,000 to 8,000 acres in Wisconsin	Protection of high-quality oak and savannah pine barrens
Suit against operators of underground injection wells in Michigan	Protection of warbler habitat
Agency helped get timber industry to abide by management plans in northwest Wisconsin	Protection of songbirds in northern hardwoods and pines
EIS rating of environmental objections (EOs) on management plan for Sunken Camp Area of Chequamegon National Forest	Potential reduction in species diversity (Franz, 1990a)

Region 9 NEPA, Office of External Affairs NEPA (R9)

Background

Decisions

Like the Office of Federal Activities, the Region 9 Office of External Affairs (OEA) performs NEPA reviews on Environmental Impact Statements (EISs).

Statutory Authority

EPA has general statutory authority under Section 309 of the Clean Air Act, the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1,500-1,508). The purposes of NEPA include: "To declare a national policy which will encourage. . . harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere . . . ; [and] to enrich the understanding of the ecological systems and natural resources important to the Nation" (NEPA §2). NEPA also requires disclosure and compliance under other appropriate laws and regulations.

Ecological Considerations

Ecological Values To Be Protected

The Region 9 OEA protects natural resources and the environment in general. Specific ecological values are presented in the Headquarters Office of Federal Activities summary.

Specific Ecological Concerns or Assessment Endpoints

Ecological assessment endpoints considered by the Region 9 OEA include the following:

- Protection of wetlands, sloughs, streams, rivers, and state and federal refuges.
- Protection of special rare habitats (e.g., coastal sage-scrub).

- Water quality standards (but in some cases these are not sufficiently protective, e.g., selenium).
- Effects on surface water and wetlands hydrology (e.g., 1000 Springs Power Plant) (U.S. EPA, 1990; Wieman, 1992b).
- Preservation of biodiversity (U.S. EPA, 1990, 1991).
- Discharge of high total loads of selenium into aquatic systems (Seraydarian, 1992; Wieman, 1992a).
- Unacceptable hazards to wildlife (Wieman, 1992a).
- Protection of threatened and endangered species.
- Protection from invasive species (e.g., the brown-headed cowbird) and exotic species.
- Protection of habitat corridors.
- Protection of riparian habitat (e.g., Glen Canyon Dam).

Examples of specific ecological assessment endpoints that have been used in Region 9 EIS rating decisions are given in Table F-5.

References and Other Sources of Information

- Seraydarian, H. 1992. Correspondence from the Director, Water Management Division, U.S. EPA Region 9, regarding the Farmington Canal (June 12).
- U.S. EPA. 1991. December 1991 Region 9 comments on Mohave Valley Resort DEIS.
- U.S. EPA. 1990. October 1990 Region 9 comments on Spirit Mountain DEIS.
- Wieman, D.M. 1992a. Correspondence from the Director Office of External Affairs, U.S. EPA Region 9, regarding comments on the DEIS for San Luis Drainage Program, Central Valley Project (April 17).
- Wieman, D.M. 1992b. Correspondence from the Director Office of External Affairs, U.S. EPA Region 9, regarding the Farmington Canal (July 16).

Table F-5. Examples of Region 9 NEPA Decisions Based on Ecological Risk

Project	Ecological Concerns Considered in Decision
National Forest spotted owl management plan	Protection of threatened species
Spirit Mountain Lake	Preservation of biodiversity (U.S. EPA, 1990)
Mohave Valley Resort	Preservation of biodiversity (U.S. EPA, 1991)
San Luis Unit Drainage Program	(1) Discharge of high total loads of selenium into the San Joaquin River, (2) unacceptable hazards to wildlife (Wieman, 1992a)
Farmington Canal	Effects on hydrology (flow) (that may ultimately adversely affect juvenile salmonids) (Seraydarian, 1992; Wieman, 1992b)

Office of Pesticide Programs PESTICIDES (HQ)

Background

Decisions

Office of Pesticide Programs (OPP) decisions involve weighing the risks associated with the pesticide under consideration against the benefits of use and against the relative risks of alternative control methods. Ecological risks alone can provide sufficient grounds for OPP to prohibit the use of a particular pesticide. More frequently, however, ecological risks are weighed along with human health risks, which help to tip the balance.

Various types of decisions at OPP make use of ecological information, including decisions involving:

- Special review.
- Registration (e.g., existing uses, new uses, new chemicals, full registration).
- Reregistration.
- Experimental use permits.
- Emergency exemptions (“section 18s”).
- Special local needs (minor additional uses).

Statutory Authority

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires that before a product can be registered unconditionally, it must be shown that it can be used without “unreasonable adverse effects on the environment” (FIFRA §§3[c][5] and 3[c][6]); that is, without causing “any unreasonable risk to man or the environment, taking into account the economic, social and environmental costs, and benefits of the use of the pesticide” (FIFRA §2[bb]).

Pesticide regulation also comes under the authority of other legislation. The Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act (BGEPA) prohibit unpermitted kills of individual members of endangered or threatened species, migratory birds, or bald or golden eagles. ESA requires that EPA use its authority to conserve listed species (ESA §7[a][1]) and ensure that any action it authorizes, funds, or carries out will not be likely to jeopardize the continued existence of a listed species or to result in the destruction or adverse modification of the critical habitat of a listed species. This duty extends to

licensing activities, such as the registration of pesticides. Another act of Congress, the Organotin Antifouling Paint Control Act (OAPCA), aims to protect aquatic life by limiting the use of tributyltin (TBT) compounds.

OPP can initiate a special review of a pesticide if the Administrator determines, “based on a validated test or other significant evidence,” that the use of the pesticide may (1) “result in residues in the environment in nontarget organisms at levels which equal or exceed concentrations acutely or chronically toxic to such organisms, or at levels which produce adverse reproductive effects in such organisms, as determined from tests conducted on representative species or from other appropriate data” or (2) pose a risk to the environment that is “of sufficient magnitude to merit a determination whether the use of the pesticide product offers offsetting social, economic, and environmental benefits that justify initial or continued registration.” Other criteria for initiating a special review include considerations regarding endangered species and habitat destruction (Criteria for Initiation of Special Review, 40 CFR 154.7, 1990).

Ecological Considerations

Ecological Values To Be Protected

Broad ecological values protected under the authority of OPP include:

- The environment.
- Nontarget terrestrial organisms.
- Nontarget aquatic organisms.
- Threatened and endangered species and their critical habitats.

Specific Ecological Concerns or Assessment Endpoints

Ecological considerations by OPP occur on a case-by-case basis (Table F-6). Such concerns have included:

- Recurring bird kills.
- Lethal, sublethal, and reproductive effects on birds and mammals.
- Lethal, sublethal, and reproductive effects on aquatic organisms.

Table F-6. Examples of OPP Decisions Based on Ecological Risk

Pesticide	Type and Date of Final Decision	Ecological Concerns or Assessment Endpoints Considered in Decision
Carbofuran (granular)	Special review; phased out most uses of granular carbofuran (PD4, 12/11/91)	Acute risk to birds (regularly repeated bird kills)
DDT	Administrative inquiry; canceled all uses for crop production and nonhealth purposes	(1) "Avian hazard" (2) Protection of bird populations (3) Potential for biomagnification (4) Human carcinogenicity
Diazinon	Special review; prohibited at golf courses and sod farms (PD4, 10/1/86; 6/19/90 press release announced remand decision)	Acute risk to birds (regularly repeated bird kills)
Mirex	Restrictions on aerial spraying (final determination 12/29/76)	(1) Carcinogenicity (2) Bioaccumulation (3) Hazard to wildlife and other chronic effects
Tributyltin (TBT)	Restricted use (PD4, 10/4/88); use limited to certain types and sizes of vessels, restriction on leaching rate	Adverse effects on nontarget organisms, including commercial species such as mollusks

Birds

OPP can prohibit pesticide uses based solely on recurring bird kills without demonstrating population effects or evaluating a threshold level of risk. For example, in *Ciba-Geigy v. EPA* (U.S. EPA, 1988d), a case regarding diazinon, it was ruled that "FIFRA gives the Administrator sufficient discretion to determine that recurring bird kills, even if they do not significantly reduce bird populations, are themselves an unreasonable environmental effect." EPA does not limit its concern to long-term adverse effects on populations, and does not tolerate unnecessary risks of regularly repeated bird kills (55 *Federal Register* 31133, Final Decision, July 31, 1990). Bird kills have served as the assessment endpoint in the decision-making process regarding a number of other pesticides, including granular carbofuran (see Table F-6).

Aquatic Organisms

OPP used field information from Europe and known effects on U.S. commercial aquatic species in its decision to conduct its special review of TBT. Evidence of sublethal and reproductive effects on aquatic animals were considered in the special review final decision. The focus for aquatic organisms has been on mitigation (e.g., keeping pesticides out of water through the use of filters, buffer strips, conservative tillage practices).

Although no thresholds have been developed for "unreasonable adverse effects," draft concern thresholds based on a quotient method have been used to decide whether further evaluation is necessary. For acute aquatic criteria, the quotient is the measured aquatic concentration divided by the acute ecological benchmark protective of aquatic life. For chronic criteria, the measured concentration divided by the lowest observed effect level (LOEL) is used as the quotient.

References and Other Sources of Information

- U.S. EPA. 1991. Granular carbofuran: Conclusion of special review; notice of final determination. Fed. Reg. December 11.
- U.S. EPA. 1990. Remand decision relating to diazinon in the matter of Ciba-Geigy Corporation et al. FIFRA Docket Nos. 562 et seq. (July 16).
- U.S. EPA. 1988a. Captafol: Decision to terminate a special review for pesticide products containing Captafol (proposed decision). Fed. Reg. July 22.
- U.S. EPA. 1988b. Captafol: Decision to terminate special review for pesticide products containing Captafol (final decision). Fed. Reg. August 31.
- U.S. EPA. 1988c. The Federal Insecticide, Fungicide, and Rodenticide Act. EPA/540/09-89/012.
- U.S. EPA. 1988d. Special review final decision relating to diazinon in the matter of Ciba-Geigy Corporation et al. FIFRA Docket Nos. 562 et seq. (March 29).
- U.S. EPA. 1988e. Tributyltin antifoulants: Notice of intent to cancel; denial of applications for registration; partial conclusion of special review. Fed. Reg. October 4.
- U.S. EPA. 1987a. Amendment to notice of intent to cancel registrations and denial of applications for registration of products containing diazinon (notice). Fed. Reg. February 25.
- U.S. EPA. 1987b. EPN: Decision not to initiate a special review (notice). Fed. Reg. December 23.
- U.S. EPA. 1987c. EPN: Proposed decision not to initiate a special review (notice). Fed. Reg. July 21.

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- U.S. EPA. 1987d. Strychnine: Intent to cancel; partial withdrawal of prior cancellation notice. Fed. Reg. March 4.
- U.S. EPA. 1986. Dicofof: Intent to cancel registrations of pesticide products containing Dicofof; denial of applications for registration of pesticide products containing Dicofof; conclusion of special review; notice of final determination. Fed. Reg. May 29.
- U.S. EPA. 1985. Intent to cancel registration of certain pesticide products containing sodium fluoroacetate ("1080"); availability of position document 4; final notice of determination concluding the special review/rebuttable presumption against registration review of sodium fluoroacetate. Fed. Reg. July 31.
- U.S. EPA. 1983. Pesticides: Intent to cancel or restrict registrations of products containing EPN; denial of applications for registration of products containing EPN; determination concluding the rebuttable presumption against registration; availability of decision document (notice). Fed. Reg. August 31.
- U.S. EPA. 1982. Toxaphene: Intent to cancel or restrict registrations of pesticide products containing toxaphene; denial of applications for registration of pesticide products containing toxaphene; determination concluding the rebuttable presumption against registration; availability of decision document. Fed. Reg. November 29.
- U.S. EPA. 1981. Rotenone: Completion of pre-RPAR review (notice). Fed. Reg. July 15.
- U.S. EPA. 1979. Endrin: Intent to cancel registrations and denial of applications for registration of pesticide products containing endrin, and statement of reasons. Fed. Reg. July 25.
- U.S. EPA. 1978. Velsicol Chemical Co. et al.: Consolidated heptachlor/chlordane cancellation proceedings (final order). Fed. Reg. March 24.
- U.S. EPA. 1976. Cancellation of registration of pesticide products containing mirex. Fed. Reg. December 19.
- U.S. EPA. 1974. Shell Chemical Co. et al.: Consolidated aldrin/dieldrin hearing; notice of intention to suspend and findings as to an imminent hazard; opinion and order of Administrator; recommended decision issued by chief administrative law judge. Fed. Reg. October 18.
- U.S. EPA. 1972. Consolidated DDT hearings: Opinion and order of the Administrator. Fed. Reg. July 7.
- U.S. EPA. 1971. O,O-Diethyl S-(2-Chloro-1-Phthalimidoethyl) Phosphorodithioate: Notice of establishment of temporary tolerance. Fed. Reg. March 18.

Region 5 Pesticides and Toxic Substances Branch PESTICIDES (R5)

Background

Decisions

The Region 5 Pesticides and Toxic Substances Branch (PTSB) uses ecological information when making decisions regarding geographic initiatives and when reviewing state management plans to protect ground water from pesticides. Registration actions and label changes have been motivated by concerns about ecological risk. Region 5 also has participated in audits of laboratories that conduct testing in support of pesticide registrations.

Statutory Authority

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is the primary legislation providing statutory authority (particularly Sections 3, 4, 18, and 24) for such decision-making. Other legislation that provides authority includes the Endangered Species Act and the Migratory Bird Treaty Act (see the Pesticides, HQ, summary.)

Ecological Considerations

Ecological Values To Be Protected

Broad ecological values protected by PTSB are the same as those protected by the Office of Pesticide Programs (OPP) (see Pesticides, HQ, summary).

Specific Ecological Concerns or Assessment Endpoints

After PTSB assessed the effects of Command herbicide on nontarget plants when it drifted to fields or forests adjacent to treated areas, OPP Headquarters required a label change concerning use of the pesticide. In an Indiana case, a diazinon user held responsible for the death of 47 mallards was fined \$1,000 per duck under the Migratory Bird Treaty Act. Effects on endangered freshwater mussels also have been considered in Region 5 through interactions with the Endangered Species Protection Program at OPP.

Although fish kills occur annually in some Region 5 lakes right after spring pesticide applications, a causal relationship has not been proven. Thus, no decisions have considered these fish kills as an assessment endpoint.

Office staff interviewed referred to examples of regulatory decisions that incorporated ecological information, including decisions involving the Great Lakes Initiative, “clean sweep” projects in several watersheds, the Great Lakes Management Plan, and four chemicals (DDT, aldrin, dieldrin, and heptachlor); however, no supporting documentation or description of assessment endpoints was provided.

Region 10 Pesticides and Toxic Substances Branch PESTICIDES (R10)

Background

Decisions

The Region 10 Pesticides and Toxic Substances Branch (PTSB) has two main responsibilities: (1) allocating grant money to states for enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); and (2) enforcing FIFRA directly. PTSB believes ecological information should be used to make decisions with respect to urban initiatives, biomonitoring, special uses (SUs), strategies concerning pesticides in ground water, threatened and endangered species, and review of environmental impact statements regarding pesticide use on federal lands.

Statutory Authority

See the Headquarters Office of Pesticide Programs (OPP) summary for specific language in FIFRA and for information on other legislation that provide additional authority.

Ecological Considerations

Ecological Values To Be Protected

The broad ecological values to be protected by the Region 10 PTSB are the same as those protected under OPP (see OPP Headquarters summary).

Specific Ecological Concerns or Assessment Endpoints

Ecological concerns that have been proposed for decision-making in PTSB Region 10 include:

- Effects on nontarget plants, including reproductive, sublethal, and nonviable seed effects.
- Effects on plant community structure and function (considered secondary or indirect effects).
- Protection of residential bird populations (urban initiatives).
- Acute bird mortality (suburban areas).
- Aquatic community structure and function (e.g., index of biotic integrity and rapid bioassessment protocols).
- Aquatic biodiversity.

PTSB Region 10 emphasizes monitoring over preregulatory programs. Because many of these monitoring programs are new, however, there is no case history showing how monitoring results have been used in actual decisions.

Ecological concerns under consideration for use, but which have not yet been used, in Region 10 include:

- Hydrostatic pressure in plants
- Chemical residues in bumblebees
- Distribution and abundance of lichens
- Seed viability

As yet it is unclear what would constitute thresholds for adverse effects for these endpoints.

References and Other Sources of Information

U.S. EPA. 1990. Pesticides in natural systems: How can their effects be monitored? Proceedings of the Conference, Corvallis, OR (December 11 and 12).

Office of Solid Waste RCRA (HQ)

Background

Decisions

The Office of Solid Waste (OSW) is responsible for both site-specific and national-level regulatory decisions concerning hazardous and nonhazardous solid wastes. Decisions pertain to:

- Regulatory development and program review.
- Hazardous waste definition and determinations.
- Subtitle C hazardous waste facility permitting.
- Corrective action under Subpart F¹.
- Corrective action under proposed Subpart S, which is similar to the Superfund remedial process (U.S. EPA, 1989c) for all environmental media².

The proposed process includes Resource Conservation and Recovery Act (RCRA) Facility Assessments (RFAs), RCRA Facility Investigations (RFIs), and Corrective Measure Studies (CMSs). Site-specific decisions (typically made at the regional level) include reviewing permits and setting facility-specific standards (e.g., emissions limits, ground-water constituent action levels) for treatment, storage, and disposal; identifying needs for corrective actions; and identifying cleanup goals for facilities. OSW also is responsible for planning RCRA implementation by regions and authorized states, which includes environmental priorities that drive permitting and cleanups. For special waste decisions (i.e., those excluded from Subtitles C and D by the Bevill Amendment), ecological impacts are considered in determining whether to regulate the special waste category.

Statutory Authority

RCRA (i.e., the Solid Waste Disposal Act including the 1976 and subsequent amendments) is the primary statutory authority for most of the decisions made by OSW. The Hazardous and Solid Waste Amendments, enacted in 1984, significantly expanded the scope and

requirements of RCRA, which is codified in Title 40 of the CFR Parts 240 to 280. RCRA includes four major programs: Subtitle D regulations cover the solid waste program, Subtitle C covers hazardous wastes, Subtitle I covers underground storage tanks, and Subtitle J covers medical wastes. For special wastes (Bevill Amendment wastes), Section 8002 applies. The Bevill Amendment excluded several high-volume, low-toxicity wastes (e.g., wastes from mineral processing, mining, oil and gas production, electric utilities [coal], and cement kilns) from Subtitles C and D. The statute required EPA to consider ecological impacts in Reports to Congress (RTCs) and in the Regulatory Determinations for these special wastes. Under Executive Order 12291, OSW is responsible for conducting regulatory impact analyses (RIAs)³ for new major regulations (e.g., the Location Standards and the Hazardous Waste Identification Rule). For the Hazardous Waste Identification Program, EPA is considering incorporating ecological endpoints in the next set of hazardous waste rulemakings.

Also, in the Toxicity Characteristic Final Rule, EPA states that “when sufficient information concerning...ecological risks [relating to RCRA hazardous wastes] is available, the Agency will compare the ecological-risk-based levels to the [current Toxicity Characteristic] regulatory levels to determine whether further revisions to those levels, based on ecological risk, are necessary” (U.S. EPA, 1990a).

Ecological Considerations

Ecological Values To Be Protected

The goals of RCRA include protecting human health and “the environment,” reducing waste, and conserving energy and natural resources. OSW regulations and permitting decisions pursuant to RCRA must comply with other federal statutes and regulations (e.g., the Endangered Species Act, the Coastal Zone Management Act).

¹ Under Subtitle C, Subpart F indicates that if hazardous constituents in ground water at the unit boundary exceed background concentrations or maximum contaminant level (MCL), corrective action required.

² Under Subtitle C, Subpart S has been proposed as part of the Part 264 regulations to address past releases at RCRA interim status or permitted facilities

³ RIAs are used to evaluate the benefits, costs, and economic impacts of regulatory alternatives. EPA develops RIAs under Office of Management and Budget (OMB) guidelines.

Specific Ecological Concerns or Assessment Endpoints

OSW has not yet issued detailed guidance on how to consider ecological risks in the context of either site-specific or national-level regulatory decisions.

The RCRA program uses some ecological concerns or assessment endpoints developed by other offices. Most frequently, exceedance of Ambient Water Quality Criteria (AWQC) for the protection of aquatic life constitutes an ecological assessment endpoint used for making decisions throughout the RCRA program. EPA AWQC were used in the Smelting and Refining RTC, Mining Wastes RTC, and Oil and Gas RTC (U.S. EPA, 1989a). Exceedance of EPA AWQC has been considered in some RIAs for national regulations (e.g., Corrective Action RIA in progress and the RIA for Listing Certain Wood-Preserving Wastes). To date, however, ecological risk assessment has provided part of the rationale for waste management regulations only in the proposed facility Location Standards; AWQC were used for the RIA for floodplains (U.S. EPA, 1989). In the wood-preserving rule for the identification and listing of hazardous wastes, EPA included ecological factors as criteria for listing toxic substances. For example, in listing pentachlorophenol (PCP), EPA considered soil erosion of wastes containing PCP from wood-preserving plants as a concern due to its potentially adverse effects on aquatic life in nearby streams (U.S. EPA, 1990b). EPA used AWQC for the protection of aquatic life to assess these risks. Exceedance of AWQC also is considered in prioritizing sites for permitting and in setting waste management standards in permits for individual facilities.

Additional ecological criteria for surface waters, sediments, and soils are being developed under the proposed Subpart S media protection standards.

The protection of wetlands and wetland values serve as a primary assessment endpoint for the unpublished Location Standards RIA for wetlands. Benefits were measured in terms of reductions in the area of wetlands destroyed, wetland restoration costs, and areal extent of contamination (U.S. EPA, 1989a). A threshold level of contamination that would impair wetland functions has not been identified, however.

Although potential bioaccumulation of contaminants also appears to be both a human health and ecological concern in the RCRA program, no examples were identified where this endpoint has formed the basis of a regulatory decision. Proposed Subpart S identifies bioaccumulation as one of the factors to be considered when evaluating corrective action alternatives (§264.525[b][2][iv]). Bioaccumulation of toxic substances in oysters was one of several ecological and other concerns used in the Oil and Gas RTC (U.S. EPA, 1989b).

Proximity of facilities to habitats used by threatened and endangered species has served as a screening-level assessment endpoint for RIAs (e.g., Coal Utilities RIA) (U.S. EPA, 1989a) and RTCs (Oil and Gas RTC, Mining Wastes RTC) (U.S. EPA, 1989c). Again, however, no specific regulatory decisions can be attributed to this endpoint.

Adverse effects on growth, reproduction, development, or survival in wildlife species are serving as assessment endpoints for “eco-RfDs.” OSW is developing a database for wildlife equivalents of human reference doses (RfDs) that will be shared with the Superfund program. How the RCRA program intends to use these values has yet to be determined (e.g., Would exceedance of an RfD for a species of concern be sufficient to justify a decision?).

Damage case studies included in special waste RTCs have included many additional ecological assessment endpoints. For example, the Oil and Gas Waste RTC included documented cases of many types of adverse ecological effects (U.S. EPA, 1989b):

- “Lethal effect on trout streams and damage to timber and habitat for deer, bear, and grouse.”
- Suppressed fish populations in all streams of the Allegheny Forest.
- Vegetation kills and suppressed growth.
- Bird and small mammal kills (trapped in oily deposits).
- Reduced fertility and growth in fish (North Slope of Alaska).

The Coal Utility Waste RTC documented fish kills and reduced abundance of benthic organisms for tens of miles of a river following a catastrophic release from one facility (U.S. EPA, 1989b). Apparently, however, ecological assessment endpoints have not been key in any special waste regulatory determinations.

To date, no hazardous waste listings have been based solely on ecological threats. In the future, wastes from carbamate production may be listed based on adverse ecological effects (e.g., acute toxicity in birds). Ecological concerns or assessment endpoints that may be considered in the near future include:

- Fish kills (e.g., from cyanide released during mining operations).
- Bird kills (e.g., from waterfowl landing in open cyanide pits).
- Soil contamination criteria (i.e., the RCRA program is establishing soil contaminant level standards for protection of the environment).

References and Other Sources of Information

- U.S. EPA. 1990a. Hazardous waste management system; identification and listing of hazardous waste; toxicity characteristics revisions (final rule). Fed. Reg. March 29.
- U.S. EPA. 1990b. Identification and listing of hazardous waste; wood preserving (final rule). Fed. Reg. December 6.
- U.S. EPA. 1989a. Ecological risk management in the Superfund and RCRA programs. EPA/230/03-89/045. Washington, DC: Office of Policy, Planning and Evaluation.
- U.S. EPA. 1989b. The nature and extent of ecological risks at Superfund sites and RCRA facilities. EPA/230/03-89/043. Washington, DC: Office of Policy, Planning and Evaluation.
- U.S. EPA. 1989c. A review and evaluation of past practices in the Superfund and RCRA programs. EPA/230/03-89/044. Washington, DC: Office of Policy, Planning and Evaluation.

Region 3 RCRA Program Corrective Action and Enforcement Sections RCRA (R3)

Background

Decisions

In Region 3, the Corrective Action and Enforcement Sections are responsible for:

- Developing Corrective Action Orders on interim status facilities.
- Deciding which remediations to use in Resource Conservation and Recovery Act (RCRA) facility cleanups.
- Determining cleanup levels.

Corrective Action Orders (i.e., RCRA Section 3008H orders) require facility property owners to conduct RCRA Facility Investigations (RFIs). EPA Headquarters provides property owners with guidance on how to conduct such an investigation (e.g., U.S. EPA no date). Later, the facility owner must conduct a Corrective Measures Study (CMS) to assess alternatives for remediation, which must be submitted to EPA Region 3 staff for review.

Statutory Authority

Statutory authority is provided by RCRA Sections 3008A (base program) and 3008H (enforcement/corrective action).

Ecological Considerations

Ecological Values To Be Protected

The goals of RCRA include protecting human health and “the environment,” and the Region 3 *RFI/CMS Ecological Assessment Guidance Document* indicates that sensitive, protected, or special status habitats and threatened and endangered species are ecological receptors of concern (U.S. EPA, no date). Also of concern are the ecological functioning of freshwater and marine wetlands, including hydrologic benefits (e.g., flood attenuation), benefits of filtering pollutants, mitigating effects on climate, water-quality benefits (e.g., removal of sediments and nutrients), and wildlife benefits (e.g., providing habitats and food sources for fish, shellfish, waterfowl and other birds, mammals, and wildlife) (U.S. EPA, no date).

Specific Ecological Concerns or Assessment Endpoints

At facilities for which surface waters are of concern, assessment endpoints can be state or other local water quality standards for designated uses or EPA acute and chronic Ambient Water Quality Criteria (AWQC) for the protection of aquatic life. For example, at the Allied Baltimore Harbor site, the RFI indicated concerns for “the ecological health of the harbor” because of exceedances of EPA AWQC for the protection of aquatic life.

For other types of endpoints, Region 3 follows Superfund guidance and approaches to site-specific ecological assessments. The ecological risk assessment procedures described in the Region 3 *RFI/CMS Ecological Assessment Guidance Document* are similar to those described in the guidance documents developed for the Superfund program (U.S. EPA, no date) (see Superfund interview summaries). Existing adverse effects in receptors of concern (e.g., special status habitats) are determined by comparison to a reference site(s) that is not impacted by the facility. The *potential* for adverse effects also serves as a broad concern within the program. More specific assessment endpoints identified in the guidance document include (U.S. EPA, no date):

- Benthic macroinvertebrate communities (using biotic index systems; serves as indicator of general water quality).
- Species diversity (compared with reference area).
- Stressed vegetation and vegetative succession.
- Riparian vegetation condition.
- Bioaccumulation of chemicals.
- Flora and fauna species abundance and diversity.
- Normal predator-prey ratio.
- Flora and fauna disease and resilience.
- Observable stress to vertebrate species (including fish, amphibians, and birds).

Examples of actual use of any of these concerns as assessment endpoints were not available.

Other facilities for which ecological concerns are or will be included in an RFI include Beazer East (Kopper's) on the Ohio River (RFI workplan approved); the Naval Air Station OCEANA, Virginia Beach; Sparrow's Point; and DuPont Glasgow, Delaware (U.S. EPA, no date). Ecological assessment endpoints being used for these sites were not identified.

References and Other Sources of Information

U.S. EPA. (No date.) RCRA facility investigation/corrective measures study: Ecological assessment guidance document (first edition). Office of RCRA Programs.

Region 5 RCRA Program Permitting and Enforcement Sections RCRA (R5)

Background

Decisions

In Region 5, under the Resource Conservation and Recovery Act (RCRA) program there are two primary activities that utilize ecological information: enforcement actions, and corrective actions for releases of hazardous wastes or hazardous constituents into the environment. Corrective actions and/or ecological assessments may be required by a permit. Permits are required for treatment, storage, and disposal facilities. Also under RCRA, Region 5 reviews facility closure plans to cleanup or contain contamination from each hazardous waste management unit. Ecological language has been added to the Model Corrective Action Plans (CAPs) of both the permitting and the enforcement portions of the Region 5 RCRA program. The purpose of this new language is to make the CAPs reflect the Agency's greater emphasis on ecological risks.

Statutory Authority

Statutory authority is provided by RCRA of 1976, as amended, under Sections 3008(a) (enforcement), 3008(h) (corrective action through enforcement), and 3004(u)(v) (corrective action through permitting). Other federal statutes applicable to many sites include Section 404 of the Clean Water Act (wetlands protection), and the Endangered Species Act.

Ecological Considerations

Ecological Values To Be Protected

The goals of RCRA include protecting human health and the environment. Wetlands, other surface waters, and endangered and threatened species and their critical habitats are among the ecological values to be protected under the "environment" portion of the RCRA goal. Ecological restoration has been accomplished in Region 5 through the penalty adjustment process

Specific Ecological Concerns or Assessment Endpoints

The Region 5 RCRA program uses Superfund guidance documents and the Risk Assessment Forum's *Framework*

for Ecological Risk Assessment (U.S. EPA, 1992) on a site-specific basis to select and evaluate endpoints for ecological assessments. These assessment endpoints are based on protection of the integrity, functionality, and/or survival of significant ecological features. These features can be at the population or community levels of the biological hierarchy.

At facilities where surface waters are of concern, state or other local water quality standards for designated uses or EPA acute and chronic ambient water quality criteria (AWQC) for the protection of aquatic life serve as assessment endpoints. Some ecological assessment endpoints are considered "obvious impacts":

- Absent or stressed vegetation
- Evidence of excess mortality (e.g., fish kills)

Additional assessment endpoints include existing or potential impacts on individuals, populations, communities, and ecosystems:

- At the individual and population levels, "mortality, growth and reproductive impairments."
- Health and structure of communities (e.g., benthic communities, wetland communities) compared with reference conditions (as inferred from recommended use of EPA's [1989] *Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish* at the Ansul Fire Protection Company facility [Smith, 1992] and recommended measures of species richness, relative abundance, and absolute dominance to monitor recovery of wetlands following a ground-water pump-and-treat remediation at Modern Plating Corporation [Wolf, 1992]).
- Contamination of food chains (e.g., Joliet Army Munitions Plant).
- Protecting ecosystems against spread of introduced species (e.g., zebra mussel example from the Great Lakes National Program Office).
- Protecting habitats of endangered or threatened species (e.g., Karner butterfly's habitat at a steel mill in Indiana).

An important assumption behind using individual- and population-level effects is that "lower order effects

[i.e., effects at lower levels of biological organization] translate into higher order effects.”

References and Other Sources of Information

Smith, R.D. 1992. Letter to Mr. George Rogers regarding Ecological assessment comments, Ansul Fire Protection, corrective action order on Consent Vn-W-90-R-30.

U.S. EPA. 1992. Framework for ecological risk assessment. EPA/625/3-91/022. Washington, DC: Risk Assessment Forum.

U.S. EPA. 1989. Rapid bioassessment protocols for use in streams and rivers, benthic macroinvertebrates, and fish. EPA/444/4-89/001. Washington, DC: Office of Water.

Wolf, J. 1992. Letter from the RCRA MI/WI Technical Enforcement Section on the Current status of wetland issues at Modern Plating Corporation, Freeport, Illinois.

Region 10 RCRA Program

RCRA Risk Assessment Coordination

RCRA (R10)

Background

Decisions

In Region 10, ecological risk assessments are incorporated in the Resource Conservation and Recovery Act (RCRA) program through decisions concerning corrective action and facility permitting. (See Region 3 RCRA interview summary for a description of EPA's role in the corrective action process.) Region 10 also ranks all sites. Then, for low-ranking sites, EPA encourages voluntary action by facility property owners; for high-ranking sites, EPA typically requires interim corrective measures, a RCRA facility investigation, and a Corrective Measures Study (CMS) prior to determination and implementation of final corrective measures. For clean closures, it must be demonstrated that the cleanup levels are protective of human health and the environment or that they do not exceed background levels (U.S. EPA, 1992). The Waste Management Branch Chief of the Hazardous Waste Division determines whether contaminated soils media need to be handled as a hazardous waste based on site-specific circumstances (e.g., sent to a regulated hazardous waste facility).

Statutory Authority

Statutory authority for corrective actions is provided by RCRA (1984 amendments) Sections 3004U and V, 3008H, 3013, 7002, and 7003. Corrective action under RCRA permits is described in 50 CFR Part 264.

Ecological Considerations

Ecological Values To Be Protected

The goals of RCRA include protecting human health and "the environment," and actions must be in line with any existing state requirements or standards. State-designated uses of surface waters identify more specific values to be protected for aquatic ecosystems (e.g., propagation of fish, shellfish, other aquatic life, and wildlife such as waterfowl and furbearers). Facilities at which releases have occurred are evaluated for any biological evidence of "environmental degradation" and the potential to expose endangered or threatened species (U.S. EPA, 1992).

Specific Ecological Concerns or Assessment Endpoints

In the RCRA program, "action levels" (i.e., concentrations of contaminants in environmental media estimated to be protective of human health and the environment) serve as key assessment endpoints at most facilities. States can promulgate their own cleanup standards; otherwise, EPA criteria must be followed. At facilities for which surface waters are of concern, action levels may be (1) state or other local water quality standards for designated uses, or (2) EPA Ambient Water Quality Criteria (AWQC) for the protection of aquatic life (fresh water or marine for acute or chronic exposures) (U.S. EPA, 1990, 1992). Some states also have action levels that serve as cleanup criteria for sediments or soils. Washington state, for instance, has developed its own sediment quality criteria for Puget Sound to protect benthic communities (U.S. EPA, 1992). For several combinations of hazardous substances and environmental media for which state standards or EPA criteria are unavailable, the RCRA program has developed action levels; however, these are based on human health concerns (i.e., Appendix A of proposed Subpart S).

In the absence of specified action levels (or in the case of multiple contaminant or multiple pathway exposures), site-specific assessment endpoints are used (U.S. EPA, 1992). Region 10 guidelines for developing action or cleanup levels for site-specific endpoints are intended to be consistent with the Superfund program. "Where RCRA guidelines and proposed rules do not specify procedures, Superfund guidance is used" (U.S. EPA, 1992). The Region 10 RCRA guidelines specify assessment endpoints indicative of *existing* "environmental degradation" (U.S. EPA, 1992), such as:

- Absent or stressed vegetation (e.g., as indicated by barren soils, discolored vegetation).
- Evidence of reduced nutrient recycling (i.e., reduced bacterial decomposition as evidenced by unusually thick leaf litter).
- Evidence of excess mortality or incidence of disease in wildlife populations (e.g., reports of fish or bird kills).

The same guidance (U.S. EPA, 1992) also specifies assessment endpoints indicative of potential *threats* to ecological values to be protected:

- Contamination of critical habitats (necessary for breeding, feeding, nesting, and sustaining life) for endangered or threatened species.
- Biomagnification in food chains.
- “Indirect biological effects” (e.g., contaminant lowers pH or oxygen level in surface waters, which in turn causes excess fish mortality).
- Threats of adverse effects in any “important” biological receptors.

Assessment endpoints that have been key for RCRA corrective action decisions in Region 10 include:

- Adverse effects on salmon runs (e.g., Wyckoff in West Seattle, Pendleton Woolen Mills in Washougal, Washington).

- Bioaccumulation of contaminants in fish, shellfish, and food chains in general (some more from a human health perspective) (e.g., Sea Fab on Harbor Island; Duwamish River).

The Region 10 Facility Environmental Priority Ranking Criteria indicate that the presence of nearby “sensitive bio-receptors or endangered species” serves as an assessment endpoint for prioritizing risks at facilities (U.S. EPA 1990, Appendix 1).

References and Other Sources of Information

U.S. EPA. 1992. Guidelines for developing ecologically and health-based cleanup levels at RCRA sites in Region 10 (interim final). EPA/910/9-92/019. Seattle, WA: Hazardous Waste Division.

U.S. EPA. 1990. Northwest RCRA corrective action strategy. EPA/910/9-90/016. Seattle, WA: Hazardous Waste Division.

Region 9 San Francisco Bay Estuary Project SF ESTUARY (R9)

Background

Decisions

The decision to add the San Francisco Bay Estuary Project to national environmental efforts was based on loss of ecological resources. Decisions made under the program include those made with respect to characterizing the problems facing the estuary, development of the management plan, funding for pilot projects, data gaps/research analysis, educational activities, and demonstrations of watershed activities including geographical and restoration projects. Estuary plans are consensus based and are not legally enforceable.

Statutory Authority

Section 320 of the 1987 amendments to the Clean Water Act (CWA) established the estuary program and funding for developing a management plan; funding for implementation is supposed to come from other sources (state, local, Section 319, Title VI).

Ecological Considerations

Ecological Values To Be Protected

The overall objective of the CWA is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (CWA §101). Specific ecological values of the San Francisco Estuary Project include restoration and maintenance of “water quality” and “a balanced indigenous population of shellfish, fish, and wildlife” of the Bay and Delta (CWA §320[b][4]). Another specific goal is to ensure protection of “the designated uses of the estuary” (CWA §320[b][4]).

Specific Ecological Concerns or Assessment Endpoints

Specific examples include (U.S. EPA, 1992):

- A halt and reversal to “the decline in the health and abundance of estuarine biota (indigenous and desirable non-indigenous), with an emphasis on natural production.”
- A halt and reversal to the decline of “habitats on which they [i.e., estuarine plants and animals] depend.”

- Restoration of “healthy estuarine habitat conditions to the Bay-Delta, taking into consideration all beneficial uses of Bay-Delta resources.”
- “[S]urvival and recovery of listed and candidate threatened and endangered species, as well as other species in decline.”
- Doubling the natural production of anadromous fish.
- Protection of “existing wetlands” and restoration and enhancement of “the ecological productivity and habitat values of wetlands.”
- A “significant increase in the quantity and quality of wetlands.”
- Prevention, control, and reduction of “pollutants entering the Estuary.”
- “Clean up of toxic pollutants throughout the Estuary.”
- Protection “against toxic effects, including bioaccumulation and toxic sediment accumulation.”
- Avoidance or offsetting of “the adverse impacts of dredging, flood control, channelization, and shoreline development and protection projects.”
- Elimination of “unnecessary dredging activities” and conduction of “dredging activities in an environmentally sound fashion.”
- Establishment and implementation of “land use and transportation patterns and practices that protect, enhance, and restore the Estuary’s open waters, adjacent wetlands, adjacent essential uplands habitat, and tributary waterways.”
- Adoption and utilization of “land use policies that provide incentives for more active participation by the private sector in cooperative efforts that protect and improve the Estuary.”

References and Other Sources of Information

U.S. EPA. 1992. San Francisco estuary project. Comprehensive Conservation and Management Plan for the Bay and Delta (draft).

**Office of Emergency and Remedial Response
Office of Solid Waste and Emergency Response
SUPERFUND (HQ)**

Background

Decisions

Site Assessment Phase

The first stage of assessing hazardous waste sites for potential listing on the National Priorities (Superfund) List (NPL) is scoring a site using the Hazard Ranking System (HRS). Actual site inspections and HRS scoring are performed at the Regional offices. Using the HRS scores, the Assistant Administrator decides which sites must be placed on the NPL. Although HRS scores included some ecological components before March 14, 1991, human health factors dominated the scores; site scores could not exceed the NPL cutoff score based only on ecological factors. The revised HRS rule (U.S. EPA, 1990a), which includes more ecological factors and sensitive environments, can result in sites being placed on the NPL solely because of ecological risks.

Remedial Action Phase

Ecological information also is incorporated into the baseline risk assessment of the Remedial Investigation/Feasibility Study process. Based on the investigation, the Region decides whether to take remedial action or not, and what kind of remedial action to take; this information is presented in the Record of Decision (ROD). Information from the baseline ecological assessment can be used to assist in developing cleanup goals and preferred remedial action alternatives.

Statutory Authority

Site Assessment Phase

The Superfund Amendments and Reauthorization Act (SARA) of 1986 required that EPA revise the HRS to give additional emphasis to potential damage to ecosystems (U.S. EPA, 1991b). A crucial criterion in the HRS is the evaluation of risks to various "sensitive environments" that are protected under other statutes or regulations (U.S. EPA, 1990a).

Remedial Action Phase

As part of the remedial investigation, the National Contingency Plan (NCP) (U.S. EPA, 1990b) directs EPA to conduct a baseline risk assessment that "characterize[s] the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (NCP §300.430[d][4]). Section 104(a)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) gives EPA the authority to utilize any remedial action necessary to protect public health or welfare or the environment, and Section 106 grants EPA the authority to require potentially responsible parties to perform removal or remedial actions "when...there may be an imminent and substantial endangerment to the public health or welfare or the environment."

In reaching its decision concerning the remedial action program, the Office of Solid Waste and Emergency Response (OSWER) also must comply with applicable or relevant and appropriate regulations (ARARs), such as the Endangered Species Act (Clay, 1991), the Clean Water Act, and the Migratory Bird Treaty Act.

Additionally, the Office of Waste Programs Enforcement works with Natural Resource Trustees (e.g., the Department of the Interior, the National Oceanic and Atmospheric Administration). Natural resource damage assessments, which are a major ecological activity under CERCLA, however, are carried out primarily by the trustee agencies.

Ecological Considerations

Ecological Values To Be Protected

Site Assessment Phase

The broad ecological values to be protected under the site assessment phase of the Superfund program are the aquatic and terrestrial "sensitive environments" that, as defined in the HRS, include habitats protected by state or federal statute, and uniquely important local areas (e.g., spawning areas).

Remedial Action Phase

The broad ecological values to be protected under the remedial action phase of the Superfund program are partly defined by the ARARs, but can include other values as well. Further information concerning ecological values and ARARs for the Superfund program is provided in interview summaries from EPA Regions.

Specific Ecological Concerns or Assessment Endpoints

Site Assessment Phase

Assessment endpoints in this phase are the specific sensitive environments evaluated in the HRS. Examples include (U.S. EPA, 1990a):

- Aquatic or terrestrial critical (or used) habitats for federal designated endangered or threatened species, marine sanctuaries, wetlands, National Parks, and coastal barriers.
- National or State Wildlife Refuges.
- Sensitive areas identified under the National Estuary Program or the Near Coastal Waters Program.
- Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters.
- Migratory pathways and feeding areas critical for the maintenance of anadromous fish species.
- Terrestrial areas utilized for breeding by large or dense aggregations of animals.
- Federal or State Scenic or Wild Rivers.
- Particular areas, relatively small in size, important to maintenance of unique biotic communities.

Both actual and potential contamination of these environments are considered, but actual contamination is more heavily weighted (U.S. EPA, 1990a).

Remedial Action Phase

Out of 70 remedial investigations completed in 1991, 47 included ecological risk assessments. Site-specific ecological assessment endpoints are included in the ROD. These include (1) protection of aquatic and terrestrial habitats, and (2) protection of rare, threatened, or en-

dangered species. Ecological field studies provide evidence of a direct link between such contamination and ecological effects (U.S. EPA, 1991a). Such evidence could include:

- Reduction in the population size of a species.
- Absence of species normally occurring in the habitat.
- Presence of species associated primarily with stressed habitats.
- Changes in community diversity or trophic structure.
- Incidence of lesions, tumors, or other pathologies (U.S. EPA, 1991a).

The Superfund site at New Bedford Harbor is an example in which the cleanup and shutdown of an operation was driven largely by ecological risks.

Although primarily outside of EPA's use, assessment endpoints from natural resource damage assessments have included damage to wildlife habitat as well as contamination of federally or state-protected environments (e.g., Wildlife Refuges, wetlands) or contamination of environments critical to federally or state-protected species.

References and Other Sources of Information

- Clay, D.R. 1991. Memorandum from Office of Solid Waste and Emergency Response on the role of the baseline risk assessment in Superfund remedy selection decisions. OSWER Directive 9355.0-30.
- U.S. EPA. 1991a. ECO update: Ecological assessment of Superfund sites: An overview. Office of Solid Waste and Emergency Response. Publication 9345.0-051.
- U.S. EPA. 1991b. The Superfund program: Ten years of progress. EPA/540/8-91/003. Office of Solid Waste and Emergency Response.
- U.S. EPA. 1990a. Hazard ranking system (final rule). Fed. Reg. December 14.
- U.S. EPA. 1990b. National contingency plan. Fed. Reg. March 8.
- U.S. EPA. 1989. Risk assessment guidance for Superfund, Vol. II: Environmental evaluation manual. EPA/540/1-89/001.

Region 3 Superfund Office SUPERFUND (R3)

Background

Decisions

In the Region 3 Superfund Office, as in other regional Superfund offices, ecological information may be used (1) to assist in establishing environmental cleanup levels, and (2) to select preferred remedial activities at Superfund sites, although there are few sites at which this has occurred. During the Remedial Investigation (RI), a baseline risk assessment for a site usually includes an assessment of ecological risks. These risks are considered during the Feasibility Study (FS), which evaluates options for site cleanup. The selected cleanup levels and remedial activities (for a Superfund site) are documented in Records of Decision (RODs).

Statutory Authority

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires that EPA protect the environment from releases or potential releases of hazardous substances from National Priority List (NPL) sites. Section 121(d)(2)(A) of CERCLA requires that Superfund remedial action meet federal and state standards, requirements, criteria, or limitations that are applicable or relevant and appropriate requirements (ARARs), including Clean Water Act (CWA) Section 404 regulations, and regulations in the Endangered Species Act (ESA), Migratory Bird Treaty Act, Marine Protection, Research and Sanctuaries Act, Toxic Substances Control Act, Clean Air Act, Fish and Wildlife Coordination Act, Wild and Scenic Rivers Act, Coastal Zone Management Act, Fish and Wildlife Improvement Act of 1978, and Fish and Wildlife Act of 1956, as well as stipulations in Executive Orders related to Floodplains (11988) and Wetlands (11990).

Ecological Considerations

Ecological Values To Be Protected

The ARARs for the Superfund program include several broad ecological concerns: self-sustaining populations of federally protected species, integrity of wetlands, ecosystems valued in state-designated uses of surface waters, and other federally or state-protected ecosystems or area uses (see Region 10 Superfund Office interview

summary). In addition, as inferred from assessment endpoints identified by Office staff, the Region 3 Superfund program is concerned with bioaccumulation of hazardous substances in aquatic and terrestrial food chains and aquatic community structure.

Specific Ecological Concerns or Assessment Endpoints

Site-specific assessment endpoints that can serve as surrogates for the broader ecological values covered by the program are used to help establish site-specific cleanup goals and remedial activities. These may be selected in cooperation with Natural Resource Trustees (e.g., Fish and Wildlife Service [FWS], National Oceanic and Atmospheric Administration). The Region 3 Superfund Office identified several assessment endpoints that are used routinely:

- Any site-specific federal ARARs.
- Endangered and threatened species.
- Chronic effects on growth, reproduction, and survivorship of aquatic and terrestrial populations.
- Effects on natural habitats, communities, and ecosystems, particularly wetlands.

Given that Rapid Bioassessment Protocols (U.S. EPA, 1989a) are often used, one may infer that aquatic community structure (e.g., species richness, presence of "intolerant" taxa) and health of aquatic organisms (e.g., incidence of physical anomalies) also must be utilized as assessment endpoints for some Superfund sites in Region 3.

For the Wildcat Landfill in Delaware, the primary assessment endpoints identified in the ROD for the pond operable unit were effects on the biota of the pond and possible effects on migratory waterfowl that might use the pond (U.S. EPA, 1989b). The FWS documented physiological effects in turtles using the pond, possibly as a result of lead uptake from the site (U.S. EPA, 1989b). EPA reported that the pond water was acutely toxic to aquatic organisms. Contaminant levels were measured in mummichogs (a small fish), turtles, and white-footed mice (DDNREC, 1988). The site threatened to contaminate the surrounding tidal wetlands and a nearby river.

The remedial action objectives stated in the ROD (U.S. EPA, 1989b) for the pond were:

- Minimize or eliminate the impact of contaminants upon biota in the pond.
- Stabilize the area of the pond to minimize or eliminate the exposure of biological organisms to contaminants from the landfill.

At the Saltville site (RI/FS stage), assessment endpoints include mercury contamination of endangered mussels and general “clean stream” values. The Dorney Road Case, which was settled out of court, set the precedent for EPA Superfund Offices to conduct wetland restorations (SARA 517 and §404[b] of the CWA).

References and Other Sources of Information

DDNREC. 1988. Wildcat Landfill, Dover, Delaware: Remedial investigation report, Vol. I: State of Delaware Department of Natural Resources and Environmental Control, Dover, Delaware. Prepared by CH₂M Hill for U.S. EPA. Document no. WDR347/054.

U.S. EPA. 1989a. Rapid bioassessment protocols for use in streams and rivers, benthic macroinvertebrates and fish. EPA/444/4-89/001. Washington, DC: Office of Water.

U.S. EPA. 1989b. Superfund record of decision, Wildcat Landfill, Delaware (second remedial action). Washington, DC.

Region 5 Superfund Office SUPERFUND (R5)

Background

Decisions

In the Region 5 Superfund Office, as in other regional Superfund offices, ecological information may be used to assist in:

- Establishing environmental cleanup levels
- Identifying areas requiring remediation
- Wetlands mitigation from remedies
- Responding to spill emergencies
- Prioritizing sites for cleanup funding

For remedial sites (i.e., National Priority List [NPL] sites), a baseline risk assessment for a site usually includes an assessment of ecological risks. These risks are considered when performing the Remedial Investigation (RI) and Feasibility Study (FS), which evaluate options for site cleanup. The selected cleanup levels and remedial activities (for a Superfund site) are documented in Records of Decision (RODs).

Statutory Authority

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires EPA to protect the environment from releases or potential releases of hazardous substances from NPL sites. Section 121(d)(2)(A) of CERCLA requires that Superfund remedial action meet federal and state standards, requirements, criteria, or limitations that are applicable or relevant and appropriate requirements (ARARs), including Clean Water Act (CWA) Section 404 regulations, Endangered Species Act (ESA) regulations, and others (see Region 3 Superfund Office interview summary).

Ecological Considerations

Ecological Values To Be Protected

The ARARs for the Superfund program include several broad ecological concerns: self-sustaining populations of federally protected species, integrity of wetlands, ecosystems of value in state-designated uses of surface waters, and other federally or state-protected ecosystems

or areas (see Region 10 Superfund Office interview summary). In addition, as inferred from assessment endpoints identified by Office staff, the Region 5 Superfund program is concerned with contamination of aquatic environments and food chains. Ecological assessment has also been very important in decision-making at Superfund Accelerated Cleanup Model Sites.

Specific Ecological Concerns or Assessment Endpoints

Site-specific assessment endpoints that can serve as surrogates for the broader ecological values covered by the program are used to help establish site-specific cleanup goals and remedial activities. These may be selected in cooperation with Natural Resource Trustees (e.g., the U.S. Fish and Wildlife Service [FWS]). The Region 5 Superfund Office identified several assessment endpoints that are used routinely:

- Sediment contamination and toxicity to benthic organisms.
- Food chain contamination.
- No observed effect levels and lowest observed effect levels for reproductive effects and acute lethality in wildlife species (e.g., robins, muskrats, mink).

Additional assessment endpoints are identified in Region 5's *Supplemental Guidance for Conducting Ecological Assessments*, although examples of their use were not provided during interviews (U.S. EPA, no date):

- Fish kills
- Vegetation die-offs
- Fish/wildlife consumption advisories
- EPA Ambient Water Quality Criteria
- State water quality standards

The *Regional Guidance for Conducting Ecological Assessments* indicates that ecological risk assessment for Superfund sites is an iterative process. The first step is to conduct a screening analysis. For this stage, Region 5 recommends using conservative assumptions. For example:

- Endpoints should be sensitive to the site contaminants and receive high contaminant exposure relative to other receptors.

-
- Effects of contaminants with similar (broadly defined) modes of toxicological action should be treated as at least additive.

The guidance indicates that ecological assessment endpoints must be clearly defined for the assessment and that often they are selected with the assistance of the regional ecologists and the Biological Technical Advisory Group (BTAG).

References and Other Sources of Information

U.S. EPA. (No date) Regional guidance for conducting ecological assessments.

Region 9 Superfund Office SUPERFUND (R9)

Background

Decisions

The Technical Support Section (TSS) provides technical assistance for other program office activities, mainly for Superfund activities. TSS has begun incorporating ecological risk into the decision-making process only recently. Thus, no completed Records of Decision (RODs) have been based on ecological risk. Some of the new RODs, however, will be based on ecological risk.

Statutory Authority

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires that EPA protect the environment from releases or potential releases of hazardous substances from National Priority List (NPL) sites. Section 121(d)(2)(A) of CERCLA requires that Superfund remedial action meet federal and state standards, requirements, criteria, or limitations that are applicable or relevant and appropriate requirements (ARARs), which include Clean Water Act (CWA) Section 404 regulations, Endangered Species Act (ESA) regulations, and other applicable regulations.

Ecological Considerations

Ecological Values To Be Protected

The ecological values to be protected are the same as those listed in the Headquarters and Regional Superfund interview summaries.

Specific Ecological Concerns or Assessment Endpoints

Assessment points that are currently being considered in Region 9 include protection of:

- Riparian habitats
- Fisheries
- Birds
- Marine mammals
- Endangered species
- Endangered winter runs for chinook salmon
- Wetlands

Table F-7 provides specific examples of cases in which ecological assessment endpoints are being considered.

Although Region 9 looks at chemical stressors, both acute (e.g., spills from mines) and chronic (e.g., metals, DDT), thresholds for the program have not yet been established. Toxicity testing will be conducted in Pearl Harbor and Camp Pendleton.

Table F-8 summarizes assessment endpoints and their associated measurement endpoints for the ecological assessment planned for the Sulphur Bank Mercury Mine site (Suchanek, 1992).

References and Other Sources of Information

Suchanek, T.H. 1992. Ecological assessment: Sulphur Bank Mercury Mine Superfund site, Clear Lake, California. Final field sampling plan for preliminary lake study.

Table F-7. Examples of Cases in Which the Region 9 Technical Support Section Is Considering Ecological Concerns

Location	Problem	Ecological Assessment Endpoints Considered
River Bank Army Depot, CA (ROD)	Zinc contamination from salt ponds	Riparian habitat
Montrose, CA	DDT-contaminated waterways to Los Angeles Harbor	Fisheries, endangered birds, and marine mammals
Iron Mountain Mine	Heavy metals, acid contamination in Sacramento River	Endangered winter runs for chinook salmon
Sulphur Bank Mercury Mine, Clear Lake, CA (see Table 2)	Tailings in lake	Fishery
United Heckathorne	DDT repackaging in San Francisco Bay	Loss of birds
Fort Ord and Monterey Marine Sanctuary	Lead from ammunition, paints, and solvents	Endangered plants on sand dunes, marine mammals
Camp Pendleton-Santa Margarita River	Paints, solvents, oil pits, and burnpits containing dioxins	Endangered plants and birds, marine mammals
Pearl Harbor, HI	Complex problems including ground-water issues; all the coral reefs are already gone	Two wildlife refuges, four endangered species (Hawaiian duck, mudhen, blacknecked stilt, and one other bird), wetlands, Bay fishery (commercial bait for tuna); habitats as a whole are <i>not</i> being considered

Table F-8. Examples of Ecological Assessment Endpoints According to the Field Sampling Plan for the Sulphur Bank Mercury Mine Superfund Site, Clear Lake, California (Suchanek, 1992)

Assessment Endpoint	Measures
Aquatic food chain contamination/exceedance of FDA action levels for human consumption of fish	California Department of Fish and Game restrictions on human consumption of fish from Clear Lake because contaminant exceeds FDA action levels Tissue residue levels in fish: surface planktivores (silversides), midwater omnivores (blackfish), benthic omnivores (catfish), and midwater predators (largemouth bass) Residue levels in plankton (base of food chain)
Benthic community structure	Comparing benthic invertebrate distribution and abundance with reference area Sediment bioassays
Benthic community contribution to food chain contamination	Tissues residue levels in macroinvertebrates (base of food chain)
Bioaccumulation in piscivorous wildlife (e.g., grebes, osprey, bald eagles, mink, raccoons)	Tissue residue levels in grebes
Bioconcentration in herbivorous wildlife	Tissue residue levels in coots

Region 10 Superfund Office SUPERFUND (R10)

Background

Decisions

In the Region 10 Superfund Office, as in other regional Superfund offices, ecological information may be used (1) to assist in establishing environmental cleanup levels and (2) to select preferred remedial activities at Superfund sites, although there are few sites at which this has occurred. During the Remedial Investigation (RI), a baseline risk assessment for a site usually includes an assessment of ecological risks. These risks are considered during the evaluation of options for site cleanup. The selected cleanup levels are documented in Records of Decision (RODs) for each Superfund site. The ROD should indicate if and how ecological information was used to make cleanup decisions for a site.

Statutory Authority

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires that EPA protect the environment with respect to releases or potential releases of hazardous substances from National Priority List (NPL) sites. Section 121(d)(2)(A) of CERCLA requires that Superfund remedial action meet federal and state standards, requirements, criteria, or limitations that are applicable or relevant and appropriate requirements (ARARs), including Clean Water Act (CWA) Section 404 regulations, Endangered Species Act (ESA) regulations, and other applicable regulations. Water quality and sediment quality criteria and standards play a particularly important role.

Ecological Assessment Endpoints

Ecological Values To Be Protected

The ARARs for the Superfund program include several broad ecological concerns: self-sustaining populations of federally protected species (e.g., see Endangered Species Act, Migratory Bird Treaty Act, Marine Mammals Protection Act), integrity of wetlands (CWA Section 404), ecosystems valued in state-designated uses of surface waters (e.g., coldwater fisheries habitat), and other federally or state-protected ecosystems or areas (e.g., State or National Wildlife Refuges, sensitive areas designated

under the National Estuary Program). In addition, as inferred from assessment endpoints identified by Office staff, the Region 10 Superfund program is concerned with commercially important species, the biological integrity of important ecosystems, and bioaccumulation of hazardous substances in aquatic and terrestrial food chains.

Specific Ecological Concerns or Assessment Endpoints

Site-specific assessment endpoints that can serve as surrogates for the broader ecological values covered by the program are used to help establish site-specific cleanup goals and remedial activities. These may be selected in cooperation with Natural Resource Trustees (e.g., the Fish and Wildlife Service, the National Oceanic and Atmospheric Administration). Examples inferred from Office staff and from RIs conducted in Region 10 include:

- Self-sustaining federally protected species (e.g., endangered snails, sturgeon, migratory birds, and waterfowl, and particularly, bald eagles).
- Wetland acreage (some protected for habitat value, other areas protected because of site-specific functioning, such as filtering or binding pollution sources).
- Surrogates for exposed and valued ecosystems (e.g., benthic macroinvertebrate communities and bottom-dwelling fish in fresh and marine surface water) (U.S. EPA, 1989).
- Self-sustaining commercially important species (e.g., waterfowl, salmon, trout, shellfish, Dungeness crabs, herring).
- Species at the top of various food chains (e.g., hawks, falcons, eagles, osprey, great blue heron).

Commencement Bay Case Study

To date, Commencement Bay is the only Region 10 Superfund site to reach a final cleanup decision (ROD) based on ecological concerns. Element P-2 of the plan required the Washington Department of Ecology (WDOE) to adopt standards for identifying and designating sediments that have observable acute or chronic adverse effects (U.S. EPA, 1989). In a cooperative agreement, EPA and WDOE established the apparent effects threshold (AET) measure of sediment toxicity to establish

sediment cleanup objectives for the Bay (U.S. EPA, 1989). The AET, which serves as an assessment endpoint, consists of three measurement categories: (1) sediment contamination levels; (2) benthic species acute toxicity tests; and (3) benthic community in situ structure (i.e., relative species abundances) compared with a reference site.

An implicit goal of EPA's remedial investigation was to maintain "the biological integrity of Commencement Bay" (an ecosystem-level endpoint) (U.S. EPA, 1989). Operationally, the Region focused on the "integrity of the benthic community" of Commencement Bay as a surrogate for this ecosystem value for several reasons: the benthic community was most exposed (through contaminated sediments), it contributes to the base of the food chain for the Bay, and it helps promote nutrient regeneration in the sediments (U.S. EPA, 1989). At Commencement Bay, the AET provided a measurement endpoint for the integrity of the benthic community, and by implication, for the biological integrity of the Bay. Additional assessment endpoints used in the Commencement Bay RIs included the health of fishery populations (as evidenced by measuring the incidence of lesions among bottom-dwelling fish) and bioaccumulation of toxic substances in wildlife (as evidenced by measures of chemical residue levels in food chain organisms and in consumer organisms) (U.S. EPA, 1989).

CWA Section 404 requirements also play a key role in the selected remedy. Since the overall goal of the project

is to enhance and protect the Commencement Bay environment for a broader range of uses, cleanup activities involving the excavation, transport, and disposal of dredge material required compensatory mitigation for any impact to habitat.

Wyckoff Eagle Harbor Case Study

This site also includes contaminated marine sediments in Puget Sound. The proposed plan identifies cleanup objectives based on the AET sediment quality approach (now Washington state standards). The cleanup objectives are aimed at Bay-wide ecosystem protection, based on protecting the benthic community. Habitat mitigation due to sediment remedial activities will be important. An ROD for one portion of the site has now been published.

Similar approaches are being used in other Superfund sites bordering Puget Sound, including the Asarco Tacoma Smelter, Harbor Island, and Tulalip Landfill.

References and Other Sources of Information

- Puget Sound Water Quality Authority (PSWQA). 1988. 1989 Puget Sound water quality management plan (final report). Seattle, WA: Monitoring Management Committee.
- U.S. EPA. 1989. Commencement Bay nearshore/tide-flats record of decision. Region 10, Seattle, WA.

Office of Pollution Prevention and Toxics—New Chemicals TOXICS (PMN) and TOXICS (BIOTECH)

Background

Decisions

The Office of Pollution Prevention and Toxics (OPPT) makes decisions based on the health and environmental risks of new and existing chemicals and bioengineered microorganisms. Major decisions that incorporate ecological information relate to sediment strategy plans and to premanufacture notifications (PMNs). The Office provides a toxic and ecological risk assessment for PMNs (Toxic Substances Control Act [TSCA] §5) and must either approve the new chemicals (or new bioengineered organisms) or decide that a risk exists and that additional review is required. OPPT also makes decisions on consent orders, voluntary testing, 5(E) significant new uses rule (SNURs), non-5(E) SNURs, forced withdrawals, denials or exemptions, and conditional grants.

Statutory Authority

TSCA mandates that “adequate data be developed with respect to the effect of chemical substances and mixtures on health and the environment” and gives EPA the authority to regulate “chemical substances and mixtures which present an unreasonable risk of injury to health or the environment” (TSCA §2[b][1] and [2]). TSCA requires the producer of a new chemical to submit a PMN, including “all existing data concerning the environmental and health effects of such substance or mixture” (TSCA §8[a][2][E]).

Ecological Considerations

Ecological Values To Be Protected

OPPT is charged with protecting “the environment” from “an unreasonable risk of injury” (TSCA §2[b][1] and [2]). “The term ‘environment’ includes water, air, and land and the interrelationship which exists among and between water, air, and land and all living things” (TSCA §3[5]).

“Protecting the aquatic environment” was the ecological value most often cited by Office staff. This value also can be inferred from the use of subchronic (e.g., 21 to 28 day exposure) tests on aquatic organisms (e.g., fish, *daphnia*, algae) as measurement endpoints. Site-specific

analyses are considered occasionally, and endpoints can include endangered species or habitat concerns.

Clements (1983) lists three principle ways in which a chemical can cause undesirable environmental effects:

- By causing a change in the structure of biotic populations through alterations in mortality, natality, and growth.
- By bioconcentrating in an organism to concentrations that are hazardous to other organisms through ingestion, including humans.
- By causing a deterioration of an abiotic resource.

Specific Ecological Concerns or Assessment Endpoints

The assessment endpoint on which the Office bases initial PMN chemical decisions is the expected *exceedance of an aquatic concentration of concern for more than 20 days out of the year* (note: the 20 days need not be consecutive). This might be considered the Office’s operational assessment endpoint and threshold for assuming a risk to aquatic ecosystems. The aquatic concentrations of concern are determined from any available acute or chronic toxicity tests on fish, *daphnia*, or algae. Thus, the assessment endpoint is essentially equivalent to the available measurement endpoint. Although each of the three types of aquatic life is of equal concern, in practice the fish toxicity value often drives the determination of risk.

Only 4.8 percent of all PMNs received (either the original notice or a later supplement), however, included acute or other data for at least one fish species. Evaluation of all other PMNs requires an analysis of structure-activity relationships (SAR) for fish toxicity.

If a risk is presumed to exist, then the Office negotiates with the manufacturer that submitted the PMN so that changes/modifications can be made to one or more components of the PMN chemical’s life cycle to reduce the environmental risk to acceptable levels.

OPPT has made decisions based on ecological rather than human health concerns for five classes of chemicals: polycationic polymers, polyanionic polymers, polyanionic monomers, surfactants, and cationic dyes.

Notably few PMN reviews of biotechnology products have been performed. Nonetheless, ecological concerns for biotechnology product reviews have been established and include:

- Unreasonable significant effects on endangered species.
- Unreasonable significant effects on wildlife.

No biotechnology cases have been decided yet based exclusively on ecological risk.

References and Other Sources of Information

Clements, R.G. 1983. Environmental effects of regulatory concern under TSCA: A position paper. U.S. EPA Health and Environmental Review Division, Environmental Effects Branch.

Nabholz, J.V. 1991. Environmental hazard and risk assessment under the United States Toxic Substances Control Act. *The Science of the Total Environment*. 109/110:649-665.

Office of Pollution Prevention and Toxics—Existing Chemicals TOXICS (ECAD)

Background

Decisions

The Office of Pollution Prevention and Toxics' (OPPT's) decisions concern the regulation of existing chemicals. Major decisions that incorporate ecological information include deciding whether to test existing chemicals, and deciding whether to prohibit or limit the use of existing chemicals or to require specific practices (e.g., labeling requirements).

Statutory Authority

The Toxic Substances Control Act (TSCA) mandates that “adequate data be developed with respect to the effect of chemical substances and mixtures on health and the environment.” TSCA also gives EPA the authority to regulate “chemical substances and mixtures which present an unreasonable risk of injury to health or the environment” (TSCA §2[b][1] and [2]). Section 4 of TSCA requires that testing be conducted for existing chemicals (1) that “may present an unreasonable risk of injury to health or the environment” and (2) that require testing to provide sufficient data to determine whether unreasonable risk exists (TSCA §4[a][1][A]). Under Section 6 of TSCA, existing chemicals may be prohibited, limited, or otherwise regulated (TSCA §6[a]).

Ecological Considerations

Ecological Values To Be Protected

OPPT is charged with protecting “the environment” from “unreasonable risk of injury” (TSCA §2[b][1] and [2]).

“The term ‘environment’ includes water, air, and land and the interrelationship which exists among and between water, air, and land and all living things” (TSCA §3[5]).

Specific Ecological Concerns or Assessment Endpoints

The following ecological concerns can be inferred from Rabert's (1991) ecological risk assessment of dioxins in sludge:

- Effects on terrestrial wildlife.
- Effects on aquatic invertebrates and fish.
- Effects on wildlife feeding on benthic organisms or fish.
- Effects on aquatic fowl.
- Effects on aquatic mammals.

The results from this assessment are being used to negotiate for more data, but not for use in a regulation at this point.

References and Other Sources of Information

- Rabert, W.S. 1991. Environmental risk assessment for TCDD- and TCDF-contaminated pulp sludges on terrestrial and aquatic wildlife. U.S. EPA Office of Toxic Substances, Health and Environmental Review Division, Environmental Effects Branch.
- U.S. EPA. 1990. Remand decision relating to diazinon in the matter of Ciba-Geigy Corporation et al. FIFRA Docket Nos. 562 et seq. (July 16).

Health and Ecological Criteria Division
Office of Science and Technology, Office of Water
WATER (CRITERIA)

Background

Decisions

The Health and Ecological Criteria Division develops aquatic life, sediment, biological, and wildlife criteria. Ecological information is used in developing methodologies and approaches for establishing criteria for limiting environmental concentrations of substances in water. The Division also is responsible for prioritizing chemicals for criteria development, developing guidance documents on how to apply criteria at various locations, and establishing methods for testing.

Statutory Authority

Section 304(a) of the Clean Water Act (CWA) provides for the protection of aquatic life and wildlife through the establishment of physical, chemical, and biological standards. The Division is charged with developing criteria for water quality that accurately reflects the latest scientific knowledge (1) “on the kind and extent of all identifiable effects on health and welfare including, but not limited to, plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, esthetics, and recreations which may be expected from the presence of pollutants in any body of water including ground water,” and (2) “on the effects of pollutants on biological community diversity, productivity, and stability, including information on the factors affecting rates of eutrophication and rates of organic and inorganic sedimentation for varying types of receiving waters” (CWA §304[a]).

Ecological Considerations

Ecological Values To Be Protected

The CWA provides for the protection of:

- The aquatic community as a whole
- The benthic community
- Plankton (CWA §304[a])
- Fish and shellfish (CWA §304[a])
- Plant life (CWA §304[a])

- Wildlife (CWA §304[a])
- Shorelines and beaches (CWA §304[a])

Specific Ecological Concerns or Assessment Endpoints

Once specific numerical criteria are established (e.g., acute or chronic Ambient Water Quality Criteria [AWQC] for chemical X), exceedance of a criterion represents both a measurement and assessment endpoint. EPA has developed national AWQC to protect aquatic communities (exclusive of benthos) for many of the CWA priority pollutants (almost all metals and many of the important pesticides). Water quality criteria for the protection of piscivorous wildlife are being developed at a national level as well as specifically for the Great Lakes region (and eventually other regions). For the Great Lakes, criteria have been established for four substances: PCBs, dioxin, DDT, and mercury. Draft sediment quality criteria have been developed for several pesticides. Biological criteria are still under development.

When developing an AWQC for the protection of aquatic life, the Division assesses protection based fairly equally on chronic and acute—and on lethal and sublethal—effects on organisms. Specific assessment endpoints for the development of these criteria include:

- Sublethal effects (chronic or acute) on benthic (infaunal and epifaunal) organisms.
- Sublethal effects (chronic or acute) or lethal effects on fish or aquatic invertebrates.
- Effects on terrestrial wildlife (limited).
- Effects on plants.
- Effects on endangered species.
- Effects on commercially important species, including salmonids.
- Biological integrity of the aquatic community.

To ensure protection of the majority of an aquatic community, toxicity tests from a minimum of eight specified taxonomic groups are required (U.S. EPA, 1985). The criterion is set to be protective of 95 percent of species in an aquatic community (U.S. EPA, 1985). The Division

assumes that aquatic community structure and function will be preserved if 95 percent of the species are protected and if a broad range of taxonomic groups are represented (Stephan, 1985).

Specific ecological concerns for the development of a water quality criterion for the protection of wildlife that feed primarily on aquatic organisms include:

- Effects on birds
- Effects on mammals

Adverse effects on wildlife can include impacts on reproduction, development, growth, or mortality—all endpoints that can affect the survival of a population. It is not necessary, however, to demonstrate population-level impacts (e.g., with use of population models).

In developing regional criteria, piscivorous wildlife likely to be found in the region are selected for evaluation. In the case of the Great Lakes criteria, three bird species and two mammalian species were selected. A criterion is developed separately for birds and mammals using

the geometric mean of the species-specific criteria developed in each group. The lower of the bird or mammalian value becomes the wildlife criterion. Thus, the criterion will not be protective of the most sensitive (i.e., to the toxic substance) and vulnerable (i.e., exposed) species considered.

References and Other Sources of Information

U.S. EPA. 1985. Guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms and their uses (NTIS No. PB85-227049). Duluth, MN: Environmental Research Laboratory.

Stephan, C.E. 1985. Are the guidelines for deriving numerical national water quality criteria for the protection of aquatic life and its uses based on sound judgments? In: Cardwell, R.D., R. Purdy, and R.C. Bahner, eds. Aquatic toxicology and hazard assessment: Seventh symposium. ASTM STP 854. Philadelphia, PA: ASTM. pp. 515-526.

***Nonpoint Source Control Branch
Assessment and Watershed Protection Division
Office of Wetlands, Oceans and Watersheds
WATER (NONPOINT)***

Background

Decisions

The nonpoint source (NPS) program was established to control nonpoint sources of water pollution nationwide. By controlling nonpoint source pollution, the program protects and enhances wildlife habitat (wildlife and recreation are the water uses most affected by nonpoint pollution). Decisions under Section 319 of the Clean Water Act (CWA) include (1) approving or disapproving state NPS assessments and management programs and (2) determining annual grant award amounts and funded activities. These decisions are made in the EPA Regional offices, rather than at Headquarters. Other decisions under Section 6217 of the Coastal Zone Management Act (CZMA) include co-deciding with the National Oceanic and Atmospheric Administration (NOAA) on approval or disapproval of state coastal nonpoint pollution control programs.

Statutory Authority

Section 319 of the CWA established the NPS grant program in 1987. Section 6217 of CZMA established the coastal nonpoint pollution control program in 1990.

Ecological Considerations

Ecological Values To Be Protected

The NPS program was established to control nonpoint pollution to all impaired or threatened surface water bodies (including rivers, lakes, estuaries, coastal waters, and wetlands). The focus is on the health of the community as a whole rather than on particular species. Specific ecological values include:

- Protection of water bodies for designated uses (e.g., wildlife, shellfishery, finfishery, recreation).

- Protection of wetlands and riparian areas, which have unique value as wildlife and fish habitat, flood control, water quality maintenance, and corridors between habitats.
- Protection of “particularly sensitive and ecologically significant waters, such as wetlands, estuaries and other coastal waters, wild and scenic rivers, and exceptional fisheries” (U.S. EPA, 1991).
- Promotion of “comprehensive watershed management, including the establishment and maintenance of protective corridors such as greenways, filter strips and wetlands along streams, lakes, and estuaries and the use of conservation easements and other land conservancy measures” (U.S. EPA, 1991).

Specific Ecological Concerns or Assessment Endpoints

Ecological concerns vary from state to state, and depend on the designated uses of the water bodies involved in each program. A watershed approach generally is used. Concerns include:

- Attainment of designated uses.
- Prevention of impairment of high-quality waters and waters currently meeting water quality standards.
- Reduced pollutant loading.
- Improving trend in the chemical, biological, and physical integrity of waters as measured by specific chemical, biological, physical, and habitat parameters.

References and Other Sources of Information

U.S. EPA. 1991. Guidance on the award and management of nonpoint source program implementation grants under Section 319(h) of the Clean Water Act.

Office of Water (Ocean Discharges) **WATER (OCN DSCHRG)**

Background

Decisions

The Office of Water (OW) makes ocean dumping decisions regarding site designation and permit issuance. The majority of these decisions are based on ecological risk.

The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) provides that ocean dumping permits may be issued upon a determination that the proposed dumping will not “unreasonably degrade or endanger” human health or the marine environment (MPRSA §§102[a], 103[a]). The act directs EPA to issue criteria for the review of permit applications, and provides that in developing such criteria EPA shall consider such factors as the effects of dumping on marine ecosystems, the need for ocean dumping, alternatives to ocean dumping, and the effect of the proposed action on aesthetic, recreational, and economic values, and on other uses of the ocean such as scientific study and living resource exploitation (MPRSA §102[a]).

Under Section 403 of the Clean Water Act (CWA), EPA is charged with issuing guidance for determining “the degradation of the waters of the territorial seas, the contiguous zone, and the oceans” (CWA §403[c][1]). Section 403 further directs that no National Pollutant Discharge Elimination System (NPDES) permit for discharges to such marine waters may be issued unless the discharges are in compliance with the Ocean Discharge Guidelines.

Section 301(h) of the CWA allows publicly owned treatment works (POTWs) discharging to ocean or saline estuarine waters to apply to EPA for a waiver of secondary treatment requirements concerning biological oxygen demand (BOD), suspended solids (SS), and pH.

Statutory Authority

OW draws its statutory authority from MPRSA and from Sections 301(h) and 403 of the amended CWA (P.L. 100-4).

Ecological Considerations

Ecological Values To Be Protected

Under MPRSA, it is EPA's determination that the disposal will present:

- No unacceptable adverse effects on human health and no significant damage to the resources of the marine environment.
- No unacceptable adverse effect on the marine ecosystem.
- No unacceptable adverse persistent or permanent effects due to the dumping of the particular volumes or concentrations of these materials.
- No unacceptable adverse effect on the ocean for other uses as a result of direct environmental impact (40 CFR §227.4).

The CWA Section 403 guidelines are used to assess “significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of the discharge and surrounding biological communities” (40 CFR §125.121[e]).

To obtain a waiver under Section 301(h), applicants must show that their less-than-secondary discharge will allow for the “protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife” (40 CFR §125.57[a][2]).

Specific Ecological Concerns or Assessment Endpoints

Although different in regulatory requirements, both Sections 403 and 301(h) are ecologically based assessment programs. These programs monitor and assess water column and sediment effects, and are intended to protect unique, sensitive, or ecologically critical species, as well as most other aquatic species.

Ecological concerns for both programs would include:

- Potential for bioaccumulation
- Effects on benthic organisms
- Effects on water column organisms
- Effects on endangered or threatened species
- Impacts to natural, special aquatic, or sensitive habitats

References and Other Sources of Information

- 40 CFR 125.56-125.67. Subpart G: Criteria for modifying the secondary treatment requirements under Section 301(h) of the Clean Water Act.
- 40 CFR 125.120-125.124. Subpart M: Ocean discharge criteria.
- 40 CFR Parts 220-229.
- Ocean Dumping Program ecological decision making: A summary. 2 pages.
- U.S. EPA. 1993a. Amended Section 301(h) technical support document (draft). Office of Water, Oceans and Coastal Protection Division.
- U.S. EPA. 1993b. Clean Water Act Section 403: Interim procedural and monitoring guidance (draft). Office of Water, Oceans and Coastal Protection Division.
- U.S. EPA. 1992a. Four-page document summarizing 301(h) technical support and guidance documents. Office of Wetlands, Oceans and Watersheds, Ocean Coastal Protection Division.
- U.S. EPA. 1992b. Transcript of ecological risk management survey. Interview with personnel from Office of Water (August 18).
- U.S. EPA. 1991a. Evaluation of dredged material proposed for ocean disposal—testing manual. Office of Water and U.S. Army Corps of Engineers.
- U.S. EPA. 1991b. Guidance for water quality-based decisions: The TMDL process. EPA/440/4-91-001. Office of Water, Assessment and Watershed Protection Division.
- U.S. EPA. 1991c. Modification of secondary treatment requirements for discharges into marine waters (proposed Rule). 40 CFR Part 125. Fed. Reg. January 24.
- U.S. EPA. 1983. Ecological impacts of sewage discharges on coral reef communities. Office of Water.

Region 9 Wetlands Permits and Enforcement Section
Wetlands, Oceans and Estuaries Branch
Water Management Division
WATER (PERMITS, R9)

Background

Decisions

The regulatory function of the Region 9 Wetlands Permits and Enforcement Section includes review of permits, regulation of unauthorized discharges, and enforcement of Section 404 of the Clean Water Act (CWA). Approximately 25 percent of these permits include monitoring for future impacts. Other Region 9 activities that incorporate ecological factors are strategic planning, watershed approach planning, and National Environmental Policy Act (NEPA) reviews.

Statutory Authority

The Region 9 Permits Section has statutory authority pertaining to CWA §404 and NEPA (i.e., review and regulation of environmental impact statements).

Ecological Considerations

Ecological Values To Be Protected

General ecological values that the Office seeks to protect are the same as for the Headquarters Office of Federal Activities and Office of Water (see Headquarters Office interview summaries). The following ecological values can be inferred from concerns described in various permit and Environmental Impact Statement (EIS) reviews:

- Protection of aquatic ecosystems and their associated functions and values, including vegetation and wildlife (e.g., birds, amphibians, reptiles, mammals).
- Protection of sensitive habitats, particularly aquatic ones (e.g., wetlands).

Specific Ecological Concerns or Assessment Endpoints

Ecological concerns used by Region 9 are described in permit and EIS reviews. For example, dredging permit cases in San Luis Rey, California, have involved several assessment endpoints: birds, fish, habitats, endangered species, and special aquatic sites that include wetlands.

In a review of a 404 permit for the Ocean Development Company to build a luxury hotel in the Republic of Palau (an island Trust Territory of the United States in the Western Pacific), Region 9 evaluated the potential damage (from filling) to 139 acres of mangrove swamps, agricultural wetlands, seagrass beds, and reef flats and decided that the construction would likely cause significant adverse effects (Seraydarian, 1991).

Another 404 permit review (for a docking facility in Humboldt County, California) included the following ecological concerns (Seraydarian, 1988):

- Intertidal and subtidal habitats and the rich diversity of benthic organisms and other fish they support.
- Vegetated shallows and eel grass habitats.
- Sandbar and mudflat habitats.

In its 404 permit proceedings regarding the Pamo Dam and Reservoir Project, Region 9 evaluated the following ecological concerns in Pamo Valley in order to veto the permit (U.S. EPA, 1987):

- Vegetation, such as wetlands, forest and understory, emergent wetlands, and riparian woodland (the project would “inundate” nine vegetation types).
- “Birds of special interest” because of sensitivity, rarity, or limited habitat (the reservoir project would cause permanent loss of their habitats and displacement of their populations).
- Amphibians and reptiles “of special interest.”
- Mammals.
- Endangered species (e.g., the least Bell’s vireo).

In its review of an EIS on an Army Corp of Engineers (COE) project to provide flood protection with a dry dam near Auburn, California, Region 9 evaluated the following ecological concerns (Wieman, 1992):

- Potential impacts to wetlands and upland habitat.
- Effects of water temperature increases and reduced flows on chinook salmon population sizes and chinook spawning and rearing.
- Open water/marsh and riparian habitat.

-
- Vegetation/channel characteristics.

In general, endangered species have carried more weight than the other ecological concerns. Terrestrial impacts (other than those involving endangered species) have received the least attention.

References and Other Sources of Information

- Seraydarian, H. 1991. Memorandum from the Director, Water Management Division, U.S. EPA, on Public Notice No. PODCO 2186 (June 5). Palau Resort Development, Ngesaol, Koror State, Palau.
- Seraydarian, H. 1988. Memorandum from the Director, Water Management Division, U.S. EPA, Public Notice No. 17492N21 (June 30). Humboldt County, CA: Allen and Finn Inc.
- U.S. EPA. 1987. Pamo Dam and reservoir project. An analysis pursuant to Section 404(q) of the Clean Water Act. Public Notice No. 85-021-GL.
- Wieman, D.M. 1992. Letter from the Director, Office of External Affairs, U.S. EPA, on comments on the EIS for American river watershed investigation.

Region 9 Water Quality Branch WATER (QUALITY, R9)

Background

Decisions

The Region 9 Water Quality Branch (WQB) is divided into two teams, the agriculture team and the San Francisco Bay Delta team. The agriculture team conducts a nonregulatory program involving the use and impacts of pesticides; the focus of the program is pollution prevention. The WQB is involved in the development of water quality standards for states.

Statutory Authority

At the regional level, the WQB has statutory authority relating to the following regulations: the Clean Water Act (specifically §404 and §319), the National Environmental Policy Act, and the Pollution Prevention Act. The U.S. Department of Agriculture/EPA Memorandum of Understanding on pollution prevention also provides authority.

Ecological Considerations

Ecological Values To Be Protected

The following ecological values are protected by the WQB:

- Fish and wildlife (protected through the Region's promulgation of water quality standards).
- Clean water in all water bodies in the Region (through pollution prevention).

Specific Ecological Concerns or Assessment Endpoints

In its water quality program, Region 9 considers the protection of the following ecological concerns:

- Attainment of water quality for state-designated uses, for which protection of fish and wildlife dominate.
- Attainment of water quality no worse than 1975 (CWA amendments).
- Threatened and endangered species.
- Pesticide toxicity effects in fish.
- Meeting water quality standards (current emphasis on selenium).
- Loss of fisheries.
- Salinity.
- Riparian habitats.
- Ecological success of salmon and striped bass.
- Benthic invertebrates.
- Acute, chronic, and sublethal effects on aquatic organisms.
- Impacts of altered flow regimes (e.g., to migratory fish).
- Fish populations and habitat conditions in the San Francisco Bay Delta.

A priority concern for the San Francisco Bay Delta team has been endangered species. Due to water scarcity, however, providing protection for certain endangered runs of threatened salmonids can sometimes be carried out only at the expense of nonendangered runs that are the basis of viable fisheries.

**Sludge Risk Assessment Branch
Health and Ecological Criteria Division
Office of Science and Technology, Office of Water
WATER (SLUDGE)**

Background

Decisions

The Sludge Risk Assessment Branch considers ecological risk when it:

- Identifies pollutants in sludge to be considered for regulation.
- Proposes regulations specifying acceptable management practices for sludge containing the identified toxic pollutants.
- Establishes numerical limits for the pollutants for various uses of the sludge.

Statutory Authority

Section 405(d)(2)(A)(i) of the Clean Water Act of 1977 required the development of sludge regulations by 1978. The Water Quality Act (WQA) of 1987 amends that act as follows: "the Administrator shall identify those toxic pollutants which, on the basis of available information on their toxicity, persistence, concentration, mobility, or potential for exposure, may be present in sewage sludge in concentrations which may adversely affect public health or the environment, and propose regulations specifying acceptable management practices for sewage sludge containing each such toxic pollutant and establishing numerical limitations for each such pollutant for each use identified under paragraph (1)(A)."

Ecological Considerations

Ecological Values To Be Protected

The WQA is designed to protect "the environment" from adverse effects.

Specific Ecological Concerns or Assessment Endpoints

Effects on sentinel species is an important ecological endpoint used to protect the terrestrial environment. The sludge risk assessment was based on existing data on species; endpoints were not selected on the basis of an a priori concern. These include effects on:

- Soil users (e.g., earthworms)
- Predators (e.g., shrews)
- Browsers (e.g., deer)

To protect the aquatic environment, Ambient Water Quality Criteria (AWQC) for aquatic life are used as assessment endpoints. AWQC are not necessarily protective of piscivorous birds and mammals, however.

EPA has set limits for the concentrations of metals in sewage sludge. For six metals (i.e., copper, chromium, nickel, zinc, selenium, and molybdenum), limits were set based primarily on ecological risk (Southworth, 1993). Assessment endpoints included:

- Phytotoxicity
- Effects on crop-eating and sludge-eating animals

Phytotoxicity was the effect of concern for copper, chromium, nickel, and zinc (Southworth, 1993). Molybdenum levels were set based on effects on crop-eating animals, including both domestic animals and wildlife (Southworth, 1993). Selenium levels were based on effects on sludge-eating animals, including both domestic animals and wildlife.

References and Other Sources of Information

Southworth, R.M. 1993. Telephone conversation between Elizabeth Ebersole, ICF, and Robert Southworth, Sludge Risk Assessment Branch, Health and Ecological Criteria Division, U.S. EPA (April 7).

Region 10 Surface Water Branch, Water Division WATER (SURFACE, R10)

Background

Decisions

The Region 10 Surface Water Branch (SWB) incorporates ecological risk into the following:

- Actions relating to Section 404 of the Clean Water Act (CWA).
- Regulation of total maximum daily loads (TMDLs).
- Regulation of dredging/ocean discharges.
- Enforcement of water quality standards.
- Development of sediment standards.
- Prevention of nonpoint source pollution and related remedial activities.

These decisions often focus specifically on water column, sediment, and riparian habitat effects. Ecological effects information is incorporated into state riparian habitat restoration projects (e.g., Oregon).

Statutory Authority

At the regional level, the SWB administers statutes and regulations pertaining to the CWA and the Coastal Zone Management Reauthorization Act of 1990.

Ecological Considerations

Ecological Values To Be Protected

The Region 10 SWB protects the following general ecological values:

- Biological integrity of surface water ecosystems
- Watersheds
- Clean lakes
- Water column
- Sediments

Specific Ecological Concerns or Assessment Endpoints

In its watershed protection program, Region 10 considers the protection of the following:

- Lethal and chronic effects in benthic communities (the apparent effects threshold [AET] triad of measurement endpoints; used as Washington state sediment quality standards; applicable or relevant and appropriate requirements [ARARs] for Superfund cleanup and National Pollution Discharge Elimination System [NPDES] and dredge spoil permits).
- Riparian habitat loss and effects (e.g., increased water temperature) (proposed Columbia Basin restoration project).
- Stream habitats (Palouse Creek habitat restoration project).
- Spawning habitats.
- Nonanadromous fish (salmon and other native fish are considered).
- Wildlife (e.g., eagles and waterfowl).
- Aquatic biotic integrity (e.g., index of biotic integrity in limited context).

Wetlands Division
Office of Wetlands, Oceans and Watersheds
WATER (WETLANDS)

Background

Decisions

The Wetlands Division's role is to develop policy for aquatic resource protection and restoration through a variety of regulatory and cooperative efforts. Ecological assessment information used by the Division includes information on the functions and values of wetland and aquatic ecosystems. That information is incorporated into decisions relating to development of regulations, guidance, and policy on such issues as:

- Wetlands categorization.
- Wetlands mitigation.
- Advance identification of wetlands.
- The relationship between wetlands and the effects and management of stormwater, nonpoint source pollution, and hazardous wastes.
- Setting directions for wetlands research.
- Development of biological criteria for water quality standards.

The Division also develops and implements strategies to assist state, tribal, and local governments in protecting wetlands. These programs are designed to protect the ecological values and functions of aquatic resources, and they include wetland conservation planning.

Statutory Authority

The Wetlands Division has authority under Section 404(b)(1) of the Clean Water Act (CWA) to develop environmental guidance and criteria regulating discharges of dredged and fill material into wetlands. EPA also has the ultimate responsibility for determining the geographic scope of jurisdiction for the Section 404 program and applicability of Section 404(f) exemptions. The Agency also shares Section 404 enforcement authority with the U.S. Army Corps of Engineers (COE). Additionally, the Administrator "is authorized to prohibit the specification...of any defined area as a disposal site...whenever [she] determines, after notice and opportunity for public hearings, that the discharge of such materials into such area will have an unacceptable

adverse effect on municipal water supplies, shellfish beds, and fishery areas (including spawning and breeding areas), wildlife, or recreational areas" (CWA §404[c]). The Division also develops policies and guidance for implementation of state certification responsibilities under Section 401 of the CWA and Section 303 water quality standards, as those authorities apply to protection of wetland systems. Finally, the Division also develops regulations for state assumption of the Section 404 regulatory program.

Ecological Considerations

Ecological Values To Be Protected

With respect to wetlands protection, EPA recognizes the values and functions of wetland ecosystems as a whole (U.S. EPA, 1992) as well as individual values and functions that wetlands provide, including:

- Aquatic diversity/abundance and wildlife diversity/abundance, including fish and wildlife habitat, habitat for endangered species, and habitat for commercially and recreationally important species, and production export.
- Recreation and aesthetics, including hiking, bird watching, fishing, and boating.
- Water quality enhancement and protection through nutrient transformation and removal, sediment retention, and stabilization.
- Ground-water recharge and discharge.
- Floodflow attenuation.

Section 404 of the CWA requires EPA to develop the substantive criteria used in evaluating discharges of dredged and fill material into waters of the United States, including wetlands. The Section 404(b)(1) guidelines are used by COE in reviewing permit applications under Section 404. In general, the guidelines address potential impacts to the physical, chemical, and biological characteristics of the aquatic ecosystem, as well as impacts to special aquatic sites such as wetlands, mud flats, coral reefs, and riffle and pool complexes. Some examples of specific ecological values that the guidelines reflect include:

- Threatened and endangered species (40 CFR §230.30).
- Fish, crustaceans, mollusks, and other aquatic organisms in the food web (40 CFR §230.31).
- Other wildlife, including “resident and transient mammals, birds, reptiles, and amphibians” and their “breeding and nesting areas, escape cover, travel corridors, and preferred food sources” (40 CFR §230.32).
- State and federal sanctuaries and refuges (40 CFR §230.40).
- Wetlands and their biological productivity (40 CFR §230.41).
- Mud flats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR §§230.42, 230.43, 240.4, and 240.45).

Specific Ecological Concerns or Assessment Endpoints

Due to the multidimensional and multifunctional nature of aquatic resources, the Division’s policy is to use a holistic approach, rather than to assess simply the relationship between a stressor (e.g., discharge of fill material) and a single component (e.g., a particular wetland function) of the aquatic ecosystem. In practice, the Division does evaluate a wetland’s ecosystem as a whole and does not merely rely on one or two components or values. Thus, all of the functions, values, and stressors are treated as assessment endpoints and are used to value the entire community.

Examples of specific endpoints that may be used in various combinations to evaluate effects on the aquatic system as a whole include (U.S. EPA, 1992):

- Effects on wetland organisms
- Effects on wetlands function
- State heritage ranking values

Some assessment endpoints are treated as special values, generally because they cannot easily be moved or replaced. Examples include:

- Endangered species
- Wading bird rookeries
- High-quality trout streams

References and Other Sources of Information

- Prothro, M.G., and D.G. Davis. 1990. Memorandum to regional nonpoint source and wetland program directors on the subject of “National guidance: Wetlands and nonpoint source control programs” (June 18).
- U.S. EPA. 1992. Office of Wetlands, Oceans and Watersheds: Responsibilities and functions. EPA/840/K-92/001.
- U.S. EPA. 1990. Guidelines for specification of disposal sites for dredged or fill material. 40 CFR Part 230. Fed. Reg. December 24.

Region 9 Policy, Wetlands and Coastal Planning Section WATER (WETLANDS, R9)

Background

Decisions

The Wetlands and Coastal Planning Section (WCPS) was created to address issues related to the protection and restoration of coastal areas, wetlands, and other aquatic resources. WCPS considers ecological concerns in making decisions regarding the following activities:

- Geographic targeting
- Strategic planning
- Comparative risk
- Dredging permits
- Watershed protection

The WCPS often initiates projects that require coordination with other Region 9 sections (U.S. EPA, 1992).

Statutory Authority

Statutory authority for WCPS comes from several sources, including the Clean Water Act (CWA) (§§104[b] and 404), the Coastal Zone Management Act, and the National Environmental Policy Act (NEPA), which provides authority for comparative risk work.

Ecological Considerations

Ecological Values To Be Protected

The Section's goals are "to maximize opportunities to improve the quality and increase the quantity of the

Region's aquatic resources" (U.S. EPA, no date). Ecological values are the same as those described in the Headquarters Office summaries.

Specific Ecological Concerns or Assessment Endpoints

Region 9 WCPS ecological assessment endpoints noted by Section staff or that can be inferred from projects for which Region 9 has awarded grants include:

- Protection of salmon runs and protection of fish in general.
- Effects on threatened and endangered species (e.g., the Santa Margarita case).
- Protection of natural habitats (especially uncommon habitats), including undammed coastal streams, vernal pools, wetlands, and riparian areas (U.S. EPA, 1992).
- Maintenance and increase in wetlands functions and values, including:
 - fish and wildlife habitat
 - water quality and quantity
 - flood loss reduction
 - recreation (U.S. EPA, 1992)

References and Other Sources of Information

U.S. EPA. 1992. Wetlands and Coastal Planning Section, quarterly project summaries list (July 15).

U.S. EPA. (No date) Wetlands and Coastal Planning Section (W-7-4) operating plan for FY93.

Region 10 Wetlands Team WATER (WETLANDS, R10)

Background

Decisions

The Region 10 Wetlands Team incorporates ecological risk into its regulatory functions involving wetlands protection. Such functions include:

- Permit review as mandated by Section 404(c) of the Clean Water Act (CWA).
- Minimizing adverse impacts of all 404 permits.
- Enforcement of restrictions on wetlands disposal.
- Regional mitigation (U.S. EPA, 1992).

Other actions of Region 10 include funding to states' wetlands programs, local planning efforts under the Coastal Zone Management Act, developing CWA 404(b) guidelines, restoration of wetlands, and involvement in the President's Wetland Protection Plan (U.S. EPA, 1992).

Statutory Authority

Under the CWA, the Wetlands Team of Region 10 administers effluent limitations (CWA §301) through its authority for inspections, monitoring, and entry (CWA §308) and federal enforcement actions (CWA §309). The Wetlands Team also enforces the Section 404(b)(1) guidelines: "Fundamental to these Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an adverse impact [on] the ecosystems of concern" (40 CFR §230.10[c]); "No discharge...shall be permitted if it...jeopardizes the continued existence of species listed as endangered or threatened, or results in likelihood of destruction or adverse modification of a habitat which is determined...to be a critical habitat" (40 CFR §230.10[b]).

In enforcing its Section 404 mitigation policy, Region 10 adopts the following definition of mitigation given in the Council on Environmental Quality (CEQ) regulations (40 CFR §1508.20): "(a) Avoiding the impact altogether by not taking a certain action...; (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) Reducing...the impact...by preservation and maintenance operations; (e) Compensation for the impact by replacing or providing substitute resources or environments."

Ecological Considerations

Ecological Values To Be Protected

Region 10 protects wetland ecosystems and the ecological values that they provide. These values are presented in the Headquarters Wetlands Division summary.

Specific Ecological Concerns or Assessment Endpoints

Ecological concerns can be inferred from various wetlands protection actions Region 10 has taken. One such action was the regional administrator's proposed determination to withdraw the specification of the Kuparuk River Unit for use as a disposal site. Assessment endpoints used in this decision included: (1) potential damage to vegetation at the site, specifically the deep pendent grass, which is an important food source for many waterfowl species; (2) adverse impacts on wildlife and their habitats (e.g., on nesting habitat of tundra swans and other migratory waterfowl); and (3) effects on endangered or threatened species (U.S. EPA, no date).

Other Region 10 actions include the aiding of states, local governments, and Indian tribes in the development of wetland protection projects. In the Skokomish River Delta Project, the main assessment endpoints were to protect against loss of wetlands acreage and to restore the delta. Other assessment endpoints included the protection of fish, shellfish, and wildlife habitats. Specifically these included the protection of (1) juvenile salmon in their estuarine habitat, (2) eel grass bed habitats, (3) flyways for ducks, geese, swans, and shorebirds, and (4) threatened bald eagle habitat (Skokomish, no date).

An example of a local wetlands protection project that EPA helped to develop was the West Eugene Wetlands Special Area Study in Oregon. Assessment endpoints in this project included: (1) the protection of a variety of wetland types and a diversity of habitats, specifically the protection of high-quality examples of each important type of wetland plant community existing in West Eugene (native Willamette prairie grassland, ash forest, cattail marsh, scrub/shrub, and open water); (2) the protection of current populations and habitats of rare, endangered, and threatened plants and animals in West Eugene; (3) the protection of an interconnected system of wetlands within a sustainable, ecologically sound system; and (4) the creation of a "mitigation

bank", (i.e., a system of restored and enhanced wetlands) (Lane Council of Governments, 1991).

Other assessment endpoints include the scarcity of the ecological system, restorability, and the economic importance of species (U.S. EPA, 1992).

References and Other Sources of Information

Lane Council of Governments. 1991. West Eugene wetlands special area study. Oregon: Lane Council of Governments.

Skokomish. (No date) Skokomish River Delta Project.

U.S. EPA. 1992. Interview with Gary Voerman, Region 10 Wetlands Team Leader, Regulatory Enforcement Coordinator.

U.S. EPA. (No date) Proposed determination to withdraw or restrict the specification of an area for use as a disposal site. Alaska: Kuparuk River Unit, North Slope Borough.