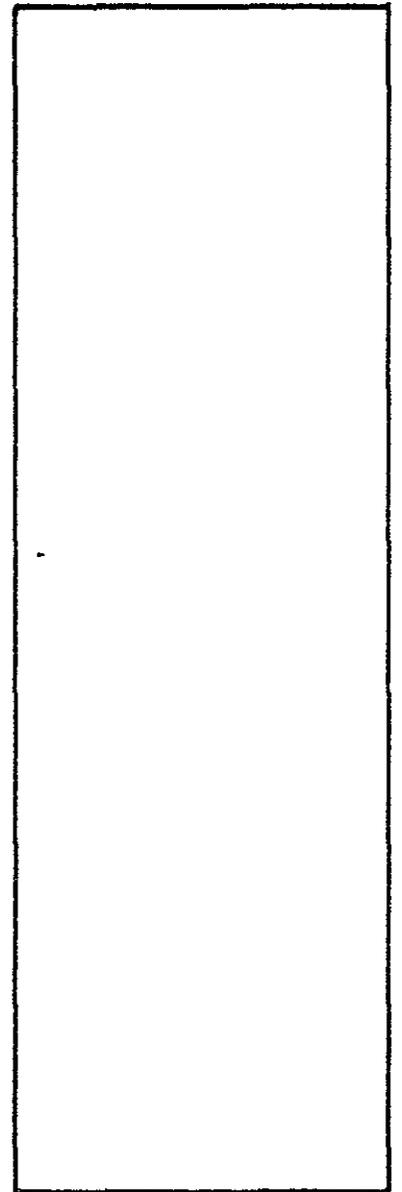
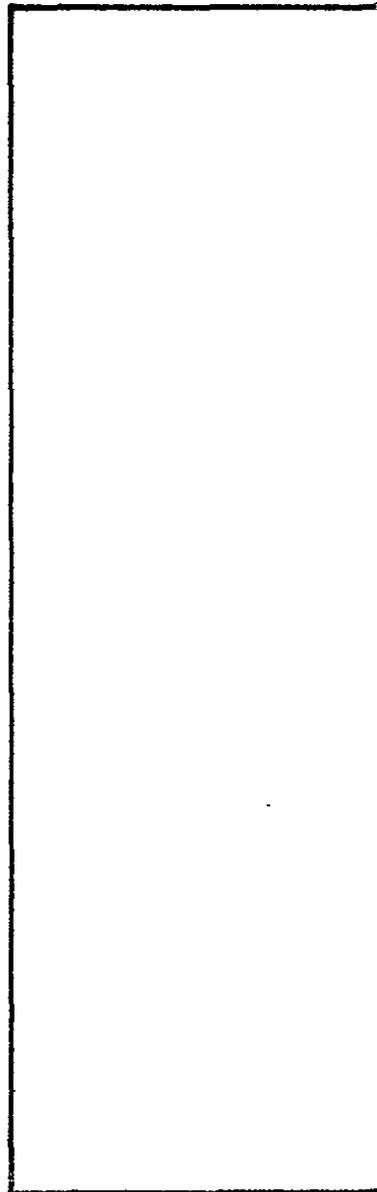


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ENVIRONMENTAL CONSIDERATIONS FOR CONSTRUCTION PROJECTS



Office of Science and Technology
Agency for International Development
Washington, D. C.

July 1971

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ENVIRONMENTAL CONSIDERATIONS

FOR

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INTRODUCTION

The quest by the developing nations of the world for higher standards of living often involves the deliberate modification of the natural environment to achieve economic objectives. However, construction of roads, dams, airports, irrigation and sewage systems, powerplants, and industrial facilities sometimes results in concomitant losses of ecological or social/cultural values. Such losses, which vary widely in magnitude, may be the result of failure to adequately consider environmental consequences during project planning and design; the lack of knowledge and information necessary to predict the eventual impact; or the absence of cost-effective environmental safeguards or economically-competitive project alternatives even if undesirable effects are forecasted.

Regardless of why the losses are incurred, it is essential that all who are involved in a proposed project -- planners, decision-makers, engineers, lending institutions -- have as clear an understanding as possible of the potential environmental consequences of a development activity at an early stage of project planning. Based on such knowledge, it may be possible to mitigate or prevent undesirable effects by incorporating pollution control technologies, redesigning the project, or selecting another site. In those instances where the magnitude of the impact is judged to be extreme, the environmental analysis may indicate that an alternative to the proposed development activity is warranted.

It is within this context that the following Environmental Considerations have been prepared for twelve categories of construction projects typically financed by international development institutions. They are designed to serve as general points of departure for analyzing the potential environmental consequences of proposed projects. Used in conjunction with the information sources cited at the end of each set of Considerations, they are useful indicators of the types of expertise and information required to address in detail the environmental aspects of various projects, as well as provide a framework for the development of procedures and guidelines for systematic review and consideration of environmental factors. This, in turn, should lead to more rational decision-making based on a clearer understanding of total short and long-term project costs in relation to anticipated benefits.

It should be recognized that the Considerations identified herein for each class of project are generalized; in application, they should be individually tailored to respond to the unique physical, economic, and social conditions encountered in a particular project. For example, roads that are constructed in arid regions of the world clearly affect that environment differently than those through tropical rain forests. In some instances, individual Environmental Considerations may not be relevant to a specific project being planned or reviewed.

The Environmental Considerations have been developed by the Office of Science and Technology, Agency for International Development. Assistance in the form of consultation, advice, and review of draft material was generously provided by other AID offices, Federal agencies concerned with similar domestic projects, and a number of international development institutions.

Environmental Considerations

ROAD CONSTRUCTION

1. What route selection criteria will be used to take into account environmental considerations such as the effects of the project on air and water quality, and on agricultural land? Have alternative routes been considered? Will the roadway and related construction activity open up new pathways for disease bearing organisms affecting humans, plants, or animals? Will provision be made for the resettlement in suitable housing of the residents displaced by construction activity? To what extent will urbanization of the roadway development have an impact on the environment?

2. Will the project have adverse effects on the habitat and migration routes of fish and wildlife resources? What will be the impact of the road on forested areas in terms of exposing such areas to inadequately regulated logging practices and attendant erosion problems? Could the roadway also be made to serve as a firebreak in forested areas? What will be the impact of the project on natural drainage patterns?

3. Do plans include provisions for preventing the pollution of surface waters and aquifers by spillage and runoff during construction or during use of roadway? Can construction of temporary drainage systems, barriers, and sedimentation basins be used to prevent eroding materials from reaching waterways. Will water impoundments create health hazards? Will wastes from machinery, asphalt and concrete plants, construction camps and shops be controlled to prevent water pollution? What will be the environmental effects of herbicides and pesticides if they are used? What measures will be taken to avoid the depletion or pollution of ground water during construction for the roadway? Will construction operations in water areas be carried out in such a way as to prevent damage to fish and other aquatic life? Will selection of borrow areas avoid use of stream bottoms and banks?

4. To what extent will air pollution occur from smoke, fumes, and sprays originating from construction operations? Will air pollution by dust from unsurfaced roads or construction operations have a deleterious affect on the environment or on human welfare?

5. What provisions will be made to prevent unnecessary despoilment of the landscape and vegetation during construction? Do plans call for restoration of roadside areas by filling, grading, dressing with top soil, reseeding, and reforestation? Will screens of shrubs or trees be planted along the roadway near population centers to reduce traffic noise and dust? Will provision be made for reclamation of abandoned roads, quarry, borrow and disposal areas? Could such areas be developed for other uses, e.g. marinas, fish ponds, recreation areas? What measures will be taken to limit clearing, grubbing, and burning to the extent practicable? Will controls be exercised over the extent of quarry, borrow and disposal areas? Will top soil be stored for respreading? What soil stabilization measures will be taken during construction to minimize damage, e.g. slope reseeding, to prevent erosion by wind or water?

ROAD CONSTRUCTION

Information Sources:

Agency Contacts:

1. Federal Highway Administration, 400-7th Street, S.W. Washington, D. C. 20590.

Documents:

1. Literature References to Highways and their Environmental Considerations, 1969 (U.S. Department of Transportation, Federal Highway Administration).
2. Federal Project Standard Specifications for Highway Construction, (U.S. Department of Transportation, Federal Highway Administration).
3. Report of the Committee on Water Quality Criteria, 1968 (U.S. Department of the Interior, Federal Water Pollution Control Administration).
4. Highway Environment Reference Book, 1970. (U.S. Department of Transportation, Federal Highway Administration).

Environmental Considerations

PORT AND HARBOR DEVELOPMENT

1. What modifications of the landscape, waterways, and offshore geology will result from the development? Will these changes adversely affect fish and wildlife resources, and if so what measures are planned to mitigate the impact? What impact will the changes have on existing or projected sewerage or waste disposal systems? Will stagnant pools develop? Will stream discharge patterns be adversely affected?

2. To what extent will land filling and dredging operations be necessary? How will dredged spoils be disposed of and with what ecological impact? What will be the source of landfill and rock materials and what are the likely effects on the environment, both at the source and at the point of deposition? What provision will be made for reclamation of quarry and barrow areas?

3. What are the pre-development coastal or waterway sedimentation patterns? How will wave and current action be modified? Will the development interrupt sediment transport needed to replenish adjacent beach areas? Might induced tidal wash and currents cause beach and coastal erosion? If the development is on a river what may the impact be on the upstream and downstream environment?

4. What cargoes are likely to be handled and what are the potential dangers to the environment from deliberate or accidental spills or dumping? What safeguards and contingency plans will be available to contain and clean up hazardous chemicals and oils?

5. Will ships and industrial development create significant air pollution from stacks in view of prevailing winds? What disposition will be made of ship and harbor sewage and other effluents?

6. What consideration has been given to providing adequate housing for the population increase that will accompany port development; to land use planning, zoning, etc. for anticipated industrial development; and to essential community services and transportation facilities.

PORT AND HARBOR DEVELOPMENT

Information Sources:

Agency Contacts:

1. Assistant Director of Civil Works for Planning and Environmental Programs, Corps of Engineers, Department of the Army, Washington, D. C. 20314.

Documents:

1. Civil Works Construction Guide Specification for Environmental Protection, CE-1300, 1970 (Department of the Army, Corps of Engineers).
2. Environmental Guidelines for the Civil Works Program of the Corps of Engineers, IWR Report 70-5, 1970 (Department of the Army, Corps of Engineers).
3. Report of the Committee on Water Quality Criteria, 1968. (Federal Water Pollution Control Administration, U.S. Department of the Interior).

Environmental Considerations

AIRPORTS

1. How will airport construction or expansion and attendant operations affect local residents of the area, as well as plant and animal life? What provisions have been made for the resettlement in adequate housing of residents displaced by the development? Even though not directly preemptive, is the airport likely to attract industry and housing to adjacent areas which possess unique and valuable ecological features? What impact would such developments have on the natural environment? To what extent will the natural habitat of valuable species of fish and wildlife be destroyed? How will any such losses be mitigated?
2. How will regional water drainage patterns be affected? Will increased water runoff clog sewerage systems or drainage ditches as a result of heavy rain or snow? What effects will the airport and the related uses of adjacent land have on the water table in the area? Will the disruption of natural water and drainage patterns complicate the operation of public water or sewer systems?
3. What disposition will be made of airport wastes, including sewage, petroleum and solid wastes? If dumped into ground "sinks", will wastes percolate into wells or aquifers? Will surface disposal degrade streams, marshes, etc. due to leaching and runoff? How will waste disposal be monitored? Have monitoring criteria been established?
4. What levels of noise can be expected from aircraft operations? How will this impact increase if the airport eventually expands? How can the disruptive effects of aircraft noise on local residents, schools, hospitals, offices, etc. be held to acceptable levels?
5. Are road patterns, land excavations, fill sites; refuse disposal activities, etc. planned so as to minimize damage to the natural environment? Will top soil be stored for respreading? What provisions have been made for restoring scarred sections of the construction area by filling, grading, and reseeding to prevent erosion?

AIRPORTS

Information Sources:

Agency Contacts:

1. System Planning Division, Airports Service, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C.

Documents:

1. Interim Instructions for Processing Airport Development Actions Affecting the Environment, 1970 (Order 5050.2, Department of Transportation, Federal Aviation Administration).
2. Noise Exposure Forecasts: Evolution, Evaluation, Extensions, and Land Use Interpretations, 1970 (Contract Report FAA No. 70-9, Department of Transportation, Federal Aviation Administration).
3. Everglades National Park Hearings Before the Committee on Interior and Insular Affairs, U.S. Senate, 91st Congress, 1st Session - On Water Supply, the Environment, and Jet Airport Problems of Everglades National Park, June 3 and June 11, 1969.
4. Report of the Committee on Water Quality Criteria, 1968 (U.S. Department of the Interior, Federal Water Pollution Control Administration).

Environmental Considerations

IRRIGATION SYSTEMS

1. To what extent will the project introduce new public health problems? Will changes in water velocities, temperatures, and depth result in a more favorable environment for insect pests and disease-bearing organisms? Will changes in water patterns introduce disease-bearing organisms into previously unaffected areas?

2. What will be the impact of the project on the biota in the water systems? Will the diversion of water to cultivated areas seriously degrade the capabilities of the original water system to support valuable biological species? Will water diversions be screened to prevent the destruction of fish? What steps are being taken to preserve fish and wildlife resources in the area? Will runoff water contain residues -- such as pesticides and fertilizers -- that contaminate downstream waters?

3. What undesirable changes in vegetation will accompany irrigation development? What is the potential for emergence of a serious aquatic weed problem?

4. What undesirable long-range changes in the environment may accompany the irrigation system development? How will salt accumulation be controlled? How does the irrigation network interact with sources of drinking water? What are the sedimentation and erosion problems? What provision has been made for monitoring the effects of the development on the environment?

5. What will be the ecological consequences of changes in land use patterns and population distribution? Will there be undesirable population crowding as villages expand either to make way for, or take advantage of, the irrigated areas? What type of environmental planning is being done to insure that the changes in population density do not aggravate sanitation and disease problems.

6. Is there a consolidated construction plan for the development that takes into account ecological factors? Are road patterns, land excavations, fill sites, refuse disposal activities, etc., planned so as to minimize damage to the natural environment? What provisions have been made for restoring barrow pits and other scarred sections of the construction area by filling, grading, and reseeding to prevent erosion?

IRRIGATION SYSTEMS

Information Sources:

Agency Contacts:

1. Branch of Foreign Activities, Bureau of Geological Survey, U.S. Department of the Interior, Washington, D.C. 20240.
2. Assistant to the Commissioner for Ecology, Bureau of Reclamation, U.S. Department of the Interior, Washington, D. C. 20240.

Documents:

1. Control of Agriculture - Related Pollution, 1969. (U.S. Department of Agriculture and Office of Science and Technology, Executive Office of the president).
2. Ground-Water Hydrology of the Punjab, West Pakistan. With Emphasis on Problems Caused by Canal Irrigation, 1967. (U.S. Department of Interior, Geological Survey Water-Supply Paper 1608-H).
3. Characteristics and Pollution Problems of Irrigation Return Flow, 1969. (U.S. Department of the Interior, Federal Water Pollution Control Administration, Robert S. Kerr, Water Research Center, Ada, Oklahoma 74820).
4. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).

Environmental Considerations

DAM CONSTRUCTION

1. What new public health problems may arise from the project? Will changes in water velocities, temperatures, and depth result in a more favorable environment for disease-bearing organisms? Will the changes in water patterns introduce disease-bearing organisms into previously unaffected areas?

2. What effect will the development have on the life cycles of resident and sea-run species of fish and on other forms of wildlife? What will be the impact on traditional fishing techniques and the resultant effect on fish populations? What provisions have been made for mitigating the effects of the development on the biota, both upstream and downstream? What is the potential for establishing new reservoir fishery resources?

3. What undesirable consequences for vegetation will accompany reservoir development? What will be the effect of the development in stimulating an influx of undesirable aquatic vegetation? Should trees and other vegetation be removed from the floor of the area to be impounded? What will be the short and long-term economic losses associated with the flooding of agriculture and forest land?

4. What undesirable consequences to the water system will accompany reservoir development? How fast will siltation occur and how will sediment buildup be handled? What will be the salinity buildup over time and how will this be handled? Will there be undesirable interactions between the change in surface water patterns and underground water sources? What physical and biological alterations will take place in downstream, estuarine, and ultimate discharge areas?

5. What will be the human and ecological consequences of changes in land use patterns and population distribution? Will there be undesirable population crowding as the residents of the flooded areas move to peripheral areas? What type of environmental planning is being done to insure that the new settlements will not be plagued by sanitation and disease problems? Will there be new settlements and cultivated areas on the hillsides surrounding the reservoir that will deposit wastes, including fertilizer and pesticides into the reservoir?

6. Will the reservoir adversely affect the development of mineral resources or archaeological finds in the area?

DAM CONSTRUCTION

7. Will the dam construction activities be carried out in a manner that will minimize damage to the natural environment? Is there a consolidated construction plan that takes into account ecological factors? Are road patterns, land excavation and fill sites, and refuse disposal activities consistent with good environmental protection practices? Will land in construction areas be restored by filling, grading, and reseeding to prevent erosion?

Information Sources:

Agency Contacts:

1. Assistant Director of Civil Works for Planning and Environmental Programs, Corps of Engineers, Department of the Army, Washington, D. C. 20314.
2. Assistant to the Commissioner for Ecology, Bureau of Reclamation, U.S. Department of the Interior, Washington, D.C. 20240.

Documents:

1. Civil Works Construction Guide Specifications for Environmental Protection. CE-1300, 1970. (Department of the Army, Corps of Engineers).
2. A Practical Guide to Water Quality Studies of Streams, 1969. (U.S. Department of the Interior, Federal Water Pollution Control Administration).
3. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).

Environmental Considerations

POWER PLANTS: FOSSIL FUEL, HYDRO AND NUCLEAR

1. What site selection criteria will be used? Will they include environmental considerations such as effects on air and water quality, and the resulting impact on residents of the area, fish, wildlife and vegetation? Will alternative sites and alternative orientations of the plant on the selected site be considered?

2. What disposition will be made of solid and liquid residues (ashes, nuclear wastes)? Does the disposal method include adequate cassetting or neutralization to minimize the danger of soil or water pollution? What steps are planned to contain and reclaim ash dumps to avoid pollution of surface and ground water by acid-laden runoff? If waste disposal into water bodies is planned, what will be the effects on aquatic life? To what degree will tidal action and currents dilute plant effluents? What provision will be made for controlling the release of radioactive waste material into water bodies? If additional units are constructed, what will the total load of radioactive waste materials be? Is the makeup of the plant's gaseous emissions known in terms of chemistry and volume? What downwind environmental effects can be anticipated with respect to humans, crops, forests, and wildlife? How can such effects be minimized?

3. What impact will thermal effluents have on the receiving waters? What temperature increase can be anticipated and how will this affect indigenous biota? Is there sufficient water motion in the receiving bodies to dissipate heat effectively? Has the use of cooling towers been sufficiently explored? What is the probability of producing undesirable fog conditions through the dissipation of waste heat?

4. What impact will the impoundment for a hydroelectric plant have in terms of the destruction of agricultural and forest lands and habitat for fish and wildlife? What measures are planned to mitigate the loss of natural habitats for fish and wildlife? To what degree will archaeological and scenic values be affected? How will the reservoir and downstream flow affect water quality parameters, i.e., temperature, dissolved oxygen, nutrients, nitrogen concentration, hydrogen sulfide, and color? (See also Environmental Considerations for DAM CONSTRUCTION).

5. How vulnerable is the power plant to surface subsidence, earthquakes, hurricanes, and other catastrophes? What is the extent and impact of the environmental degradation which could be expected in the event of such catastrophes? What preventative and remedial safeguards for downstream inhabitants will be incorporated in plant design and construction? What provisions are made for training plant operators in environmental protection?

6. Have the environmental consequences of power transmission been considered in site selection? What steps are planned to avoid soil erosion and the silting of streams as transmission facilities and access roads are constructed?

7. What provision has been made for industrial development associated with the power plant? What impact will that activity have on the environment?

POWER PLANTS: FOSSIL FUEL, HYDRO AND NUCLEAR

Information Sources:

Agency Contacts:

1. Assistant Director of Civil Works for Planning and Environmental Programs, Corps of Engineers, Department of the Army, Washington, D. C. 20314.
2. Assistant to the Commissioner for Ecology, Bureau of Reclamation, U.S. Department of the Interior, Washington, D.C. 20240.
3. Office of Environmental Affairs, Atomic Energy Commission, Washington, D.C. 20545.

Documents:

1. Electric Power and the Environment, 1970. (Executive Office of the President, Office of Science and Technology).
2. Environmental Criteria for Electric Transmission Systems, 1970. (U.S. Departments of Interior and Agriculture).
3. Environmental Effects of Producing Electric Power, Parts I, II, III, 1969-70. (Record of Hearings by the Joint Committee on Atomic Energy, Congress of the United States, 91st Congress).
4. Civil Works Construction Guide Specification for Environmental Protection, CE-1300, 1970. (Corps of Engineers, Department of the Army).
5. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of Interior, Federal Water Pollution Control Administration).
6. Air Quality Criteria (5 volumes) for (1) Photochemical Oxidants; (2) Hydrocarbons; (3) Particulate Matter; (4) Carbon Monoxide; and (5) Sulfur Oxides, 1970. (U.S. Department of Health, Education, and Welfare, Public Health Service).

Environmental Considerations

PETROLEUM-PETROCHEMICAL INDUSTRY

1. Will environmental considerations, including human land use patterns in the vicinity, be incorporated into the selection of the location and the plant design? Have hydrologic, geologic, seismologic, and meteorologic studies of the site been made to anticipate and minimize damage to humans and to the environment should natural disasters or human accidents occur? What features for environmental protection will be incorporated in the plant design and operation?

2. What will be the types and quantities of effluents produced by the plant? Will effluents contain toxic materials? If effluents are to be discharged directly or indirectly into a water body, have studies been made of the physical and chemical properties of the receiving water, e.g., temperature, current patterns, dissolved oxygen, etc. What effects will effluents have on water supply sources, algae growth, and invertebrate and fish populations? Will plant effluents be controlled and monitored? What control techniques will be provided to remove toxic materials from effluents? Are there opportunities to economically reclaim or recycle wastes to reduce effluent volume? Will the discharge of effluents into water bodies be compatible with other present and future uses of the receiving waters, particularly during periods of minimum stream flow?

3. Will the plant produce emissions that can have a deleterious effect upon indigenous biota? What will be the effects on residents of the area? Will new health problems occur? Will odors be controlled? What measures have been taken to remove contaminants from plant emissions?

4. Will the plant produce solid wastes? If solid wastes are produced, what disposition will be made of them? Has the recycling of solid wastes been considered? What provisions have been made for training plant operators in environmental protection?

5. Do offloading and onloading methods of handling petroleum and chemical products incorporate human and environmental safeguards? What are the dangers of an explosion or spills of hazardous materials? Will clean-up contingency

plans, including manpower and materials, be available to cope with accidents? Has adequate attention been given to the design and construction of safe storage facilities for hazardous materials?

6. Is there a comprehensive construction plan for the development that takes into account ecological factors? Are road patterns, land excavations, fill sites, refuse disposal activities, etc., planned so as to minimize damage to the natural environment? What provisions have been made for restoring scarred sections of the construction area by filling, grading, and reseeding to prevent erosion?

PETROLEUM-PETROCHEMICAL INDUSTRY

Information Sources:

Agency Contacts:

1. Office of Environmental Geology, Geological Survey, U.S. Department of the Interior, Washington, D.C. 20240.
2. Committee for Air and Water Conservation, American Petroleum Institute (Industry), 1801 K Street, N.W., Washington, D. C. 20006.

Documents:

1. Aqueous Wastes from Petroleum and Petrochemical Plants, 1967 (Milton R. Beyshok).
2. Environmental Conservation, The Oil and Gas Industries, Vol. 1 - A Summary, 1971 (The National Petroleum Council, Washington, D. C.).
3. The Impact of the Oil Industry on the Environment, (W.C. Hopper & B. Rayzacher - Stichting Concawe, 21, President Kennedylaan, The Hague 2012, The Netherlands).
4. Report of the Committee on Water Quality Criteria, 1968 (U.S. Department of the Interior, Federal Water Pollution Control Administration).
5. Air Quality Criteria (Five Volumes) for (1) Particulate Matter; (2) Carbon Monoxide; (3) Hydrocarbons; (4) Sulfur Oxide; and (5) Photochemical Oxidants, 1969-1970 (U.S. Department of Health, Education and Welfare; Public Health Service).

Environmental Considerations

MINING ACTIVITIES

Onshore

1. What environmental safeguards will be incorporated into mineral exploration and production agreements?

2. What provisions (housing, community services, etc.) have been made for families that will be displaced by or attracted to the mining development? Will the mining development create health or sanitation problems? Will settling ponds attract insect pests or create other potential disease problems?

3. To what extent will mining activities adversely affect adjacent land use patterns? Will noise associated with blasting and other mining operations have undesirable impacts on nearby human and wildlife populations? Will underground water and surface water runoff patterns be adversely affected? What measures will be taken to prevent land subsidence in areas in which underground mining is carried out?

4. What measures will be taken to prevent water pollution from mine drainage directly or indirectly into water bodies? Will pollution controls be incorporated into processing operations to prevent the discharge of toxic effluents into the water? What are the specific effluents of concern and what are their most troublesome characteristics? Will the discharge of effluents be compatible with other present and future uses of the receiving water, particularly during periods of minimum stream flow? Will water and land biota be adversely affected from runoffs from spoils and tailings?

5. What provisions have been made to prevent air pollution from coal fires and smouldering slag heaps? Will processing operations incorporate controls to prevent release of toxic gases, fumes, and particulates? Will access roads constitute a source of dust pollution? What measures can be taken to reduce air pollution from mining-operation smoke and dust?

6. Will mining operations be a source of land erosion and despoilment? Will strip mines be reclaimed and replanted? Have provisions been made to reclaim spoil dumps; tailing piles?

Offshore

7. What effect will drilling, dredging, or related exploration operations have on the marine environment? Have dredging disposal areas been chosen for minimum deleterious impact upon the biota? What measures will be taken to prevent water pollution from tower or service boat discharges of oil, sewage, or toxic drilling mud? Do the production systems include accident prevention equipment such as storm chokes and blowout preventors? Will monitoring of safety equipment take place regularly?

8. Is there a contingency plan for coping with blowouts and spills that includes boats, manpower and control equipment? What type of control and clean-up technique will be employed; boom containment, dispersants, sorbents, a mix? If dispersants or detergents are to be used, what will be the effect on the marine environment? Has an estimate of the effect on the marine environment of a major oil spill been incorporated into project planning? Could a spill kill significant portions of the marine biota and severely impair economic values and the well-being of people residing in the area?

9. Will pipeline or shipborne delivery systems constitute a hazard to the environment from ruptures or spills?

MINING ACTIVITIES

Information Sources:

Agency Contacts:

1. Special Assistant for Environmental Activities, Bureau of Mines, U.S. Department of the Interior, Washington, D. C. 20240.

Documents:

1. Bureau of Mines, U.S. Department of the Interior:
 - a. Surface Mining and Our Environment, 1967.
 - b. Chemical and Vegetative Stabilization of a Nevada Copper Porphyry Mill Tailing, RI-7261, 1969.
 - c. Reclamation of Acidic Coal-Mine Spoil with Fly Ash, RI-7504, 1971.
 - d. Survey of Burning Coal-Mine Refuse Banks IC-8209, 1964.
 - e. Surface Mine Reclamation, Moraine State Park, Pennsylvania, IC-8456, 1970.
 - f. A Method for Extinguishing and Removing Burning Coal Refuse Banks, IC-8485, 1970.
2. Mine Drainage Treatment - State of the Art and Research Needs, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).
3. Environmental Challenge (Engineering and Mining Journal, April 1971).
4. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).
5. Air Quality Criteria (Five Volumes) for (1) Particulate Matter; (2) Carbon Monoxide; (3) Hydrocarbons; (4) Sulfur Oxide, and (5) Photochemical Oxidants, 1969-1970. (U.S. Department of Health, Education, and Welfare; Public Health Service).

Environmental Considerations

SMELTING PLANTS

1. What environmental factors will be considered in site selection and plant design? Will alternative sites or alternative orientations of the plant be considered in an effort to mitigate downwind effects and/or water quality degradation?

2. What are the types and quantities of the gaseous, liquid, and solid wastes which will result? What effluent controls will be incorporated and what additional safeguards are possible given different levels of plant investment? How will plant emissions be monitored? What provision will be made for training plant operators in environmental protection?

3. What is the potential impact of plant emissions on plant, animal and human ecology in the immediate vicinity, and downwind or downstream? Will acidic fumes affect downwind crops, forests, or urbanized areas (e.g., fluorine from aluminum smelting; sulfur oxides from non-ferrous metals smelting)? Will the character and quantities of effluents discharged into surface waters be compatible with present and future uses of such waters?

4. What disposition will be made of ashes and slag? What effect will direct dumping or runoff from dumps have in degrading surface or subsurface water quality or flow patterns?

5. How will raw materials, particularly industrial chemicals, be handled and stored? Have provisions been made to prevent runoff of toxic materials into water bodies in the event of accident? Will materials carried by ship or barge be safely packaged and handled? Is there an adequate safety plan to cope with accidents and accidental spillages?

6. Are there plans for plant expansion or related industrial and residential construction? Is the site adequate for such later expansion without harmful environmental effects? Are road patterns, land excavations, fill sites, refuse disposal activities, etc. planned so as to minimize erosion and other damage to the natural environment? What provision is being made for reclaiming disposal dumps and restoring and reseeded scarred sections of the site?

SMELTING PLANTS

Information Sources:

Agency Contacts:

1. Special Assistant for Environmental Activities, Bureau of Mines, U.S. Department of the Interior, Washington, D. C. 20240.
2. Division of Metallurgy, Bureau of Mines, U.S. Department of the Interior, Washington, D.C. 20420.

Documents:

1. The Recovery of Elemental Sulfur from Base Metal Smelters (Mining Engineering, January 1970).
2. Environmental Challenge, (Engineering and Mining Journal, April 1971).
3. SO₂ from Smelters-Three Processes from an Overview of Recovery Costs (Environmental Science and Technology, Vol. 4, No. 7, July 1970).
4. Report of the Committee on Water Quality Criteria, 1968 (U.S. Department of the Interior, Federal Water Pollution Control Administration).
5. Air Quality Criteria (Five Volumes) for (1) Particulate Matter; (2) Carbon Monoxide; (3) Hydrocarbons; (4) Sulfur Oxide; and (5) Photochemical Oxidants, 1969-1970. (U.S. Department of Health, Education and Welfare; Public Health Service).

Environmental Considerations

PULP AND PAPER INDUSTRY

Plant Operations

1. What are the types and quantities of the waste to be discharged into the atmosphere? What will be their potential impact on plant, animal, and human ecology? Are there likely to be additional impacts? Are controls on atmospheric emissions, including odors, to be incorporated? Will the effectiveness of the controls be monitored at the plant and downwind? Should additional safeguards be considered to further restrict the emissions or their effects (i.e., increased stack height; chemical or physical scrubbers)?

2. What types and quantities of wastes will be discharged into surface waters? Can these be further reduced or eliminated? Have the oxygen content, biota, and circulation patterns of the receiving waters been investigated to support predictions of water quality changes? What will be the effects of maximum discharge volume on water quality during periods of minimum stream flow? During such periods, will the character and volume of the effluent be compatible with other present and future uses of the receiving water?

3. How will chemical raw materials and wastes be handled and stored? What will be the effects on the environment of storage tank rupture, leakage, or spillage during handling? Will drainage of spilled or leaked materials contaminate public water supplies or degrade surface waters? What provisions exist for training plant operators in environmental protection?

4. Are there plans for eventual plant expansion or related industrial and residential construction? Is the site adequate for such later expansion without harmful environmental effects? Are road patterns, land excavations, fill sites, refuse disposal activities, etc. planned so as to minimize erosion and other damage to the natural environment?

Logging

5. What provisions are being made to minimize erosion and the siltation of water bodies as the result of logging operations? Is there sufficient information about regional topography and soil types on which to base effective measures for controlling erosion and siltation? Will the rate and pattern of cutting affect the region's ecology? Will the logging be carried out in accordance with recognized forest management practices, including provision for cutting patterns and revegetation to retard erosion? What effect will logging operations and the construction of access roads have on fish and wildlife resources and scenic values of the region?

PULP AND PAPER INDUSTRY

Information Sources:

Agency Contacts:

1. Forest Products and Engineering Research, The Forest Service, U.S. Department of Agriculture, Washington, D.C. 20250.
2. Office of Research and Monitoring, Environmental Protection Agency, Washington, D.C. 20460.
3. National Council of the Paper Industry for Air and Stream Improvement, Inc., 103 Park Avenue, New York, New York 10017.

Documents:

1. Wastes in Relation to Agriculture and Forestry, 1968. (U.S. Department of Agriculture, Misc. Publication No. 1065).
2. Control of Agriculture - Related Pollution, 1969. (U.S. Department of Agriculture).
3. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).
4. Air Quality Criteria (Five Volumes) for (1) Particulate Matter, (2) Carbon Monoxide, (3) Hydrocarbons, (4) Sulfur Oxide, and (5) Photochemical Oxidants, 1969-1970. (U.S. Department of Health, Education, and Welfare, Public Health Service).

Environmental Considerations

FERTILIZER PLANTS

1. What environmental factors will be considered in site selection and plant design? Will consideration be given both to the direct effects of the plant on the site and also to potential secondary impacts from homes and industry which may be attracted to adjacent land? Are there plans for plant expansion? Will the site be suitable for future expansion without harmful environmental effects?

2. What types and quantities of gaseous, liquid, and solid wastes will be discharged into the atmosphere, soil and water? Will such discharges be compatible with the laws and regulations of the country concerned? What alternative methods of disposition have been considered? Are emission controls incorporated into plant design and operations? Given different levels of plant investment, what additional safeguards and controls can be incorporated and how would each affect the emissions? Will plant wastes be monitored? Will plant operators be trained in environmental protection?

3. What is the potential impact of plant emissions on plant, animal, and human ecology in the immediate vicinity, and downwind or downstream? Will nitrogen and phosphorus entering surface water bodies stimulate growth of algae and aquatic weeds?

4. How will raw materials and hazardous products of the plant be handled and stored? Is there an adequate safety plan to cope with releases of toxic materials due to accidental spillage, or earthquakes or other catastrophes? Has provision been made to prevent toxic chemicals released by spills, leakages, or ruptures from contaminating surface and ground waters?

FERTILIZER PLANTS

Information Sources:

Agency Contacts:

1. Branch of Applied Science, Division of Chemical Development, Tennessee Valley Authority, Mussel Shoals, Alabama.
2. The Sulphur Institute, 1725 K Street, N.W., Washington, D. C. 20006.

Documents:

1. Waste in Relation to Agriculture and Forestry, 1968. (U.S. Department of Agriculture, Miscellaneous Publication No. 1065).
2. Bibliography #1042 - Pollution from Fertilizer Manufacturing Plants, 1960-1970. (Tennessee Valley Authority, Division of Chemical Development).
3. Bibliography #1013 - Nitrogen Oxides: Toxicity and Control. (Tennessee Valley Authority, Division of Chemical Control).
4. Engineering and Cost Study of Emissions Control in the Phosphate Industry. Publication in process (Environmental Protection Agency, Air Pollution Control Office).
5. Air Quality Criteria (Five Volumes) for (1) Particulate Matter; (2) Carbon Monoxide; (3) Hydrocarbons; (4) Sulfur Oxide; and (5) Photochemical Oxidants, 1969-1970. (U.S. Department of Health, Education and Welfare, Public Health Service).
6. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).

Environmental Considerations

SEWERAGE AND SEWAGE TREATMENT PROJECTS

1. Will the project provide a system for domestic and industrial wastes separate from the disposition of storm water? If separate systems are provided what provision has been made for storm water drainage? If combined, what effects can be anticipated if the system overloads? Can the system be economically designed to accommodate or eliminate overload problems, perhaps with storage or pumping or by separating the sewage and stormwater components? Will the sewer system create new health problems by transporting and concentrating wastes at new locations? What effects will the sewage system have on water supply sources?

2. Has the site for the sewage-treatment plant been selected so as to provide maximum compatibility with land-use plans, human health and welfare, and other environmental considerations? Will gases, odors, insects, and disease vectors be a problem? What types of waste treatment equipment are proposed that might cause air pollution, i.e. incinerators or digesters? Are adequate air pollution controls provided? Is the project designed so that future expansion can be incorporated in a manner consistent with the protection of the environment?

3. What type of sewage will the plant process: domestic, industrial, mixed? What percentage of the waste in each category will be processed and how effective will the treatment be for each type? What type of toxic materials can be expected in raw sewage inputs, e.g., heavy metals, oils, hydrocarbons, other chemical compounds? Will the plant be designed to remove toxic materials? What sewage ordinances are provided to protect the system and personnel from explosives and other dangerous materials? What provisions have been made for the effective monitoring of plant effluents?

4. What are the present and projected uses of the water ways into which the project effluent will be discharged? Will the level of treatment provided be compatible with the present and projected uses of the receiving waters? What effect will the effluent have on the dissolved oxygen regimen of the receiving waters? What effect will the effluent have on the aquatic biota in the vicinity of the plant and downstream? Have seasonal variations in water flow and temperature and water levels been considered? Is thermal pollution of the waterway an associated problem? Has control of water-borne

diseases and vectors been considered? What effect will the location of outfalls have on domestic and agricultural uses of the water course? Will the effluent be satisfactorily disinfected? What provision has been made for the disposal of sludge in a manner that will not adversely affect public health and welfare or the environment?

5. What provisions have been made for training the professional, technical and operator manpower in the environmental aspects of the system? What type of maintenance will be required? Will funds be available? Is jurisdictional responsibility clearly established to insure the operation of the system in a manner that will protect or enhance the environment?

6. Is there a consolidated construction plan for the development that takes into account ecological factors? Are road patterns, land excavations, fill sites, refuse disposal activities, etc. planned so as to minimize damage to the natural environment? What provisions have been made for restoring scarred sections of the construction area by filling, grading, and reseeded to prevent erosion?

SEWERAGE AND SEWAGE TREATMENT PROJECTS

Information Sources:

Agency Contacts:

1. Office of Research and Monitoring, Environmental Protection Agency, Washington, D.C. 20460.

Documents:

1. Federal Guidelines - Design, Operation and Maintenance of Waste Water Treatment Facilities, 1970. (U.S. Department of the Interior, Federal Water Quality Administration).
2. Report of the Committee on Water Quality Criteria, 1968. (U.S. Department of the Interior, Federal Water Pollution Control Administration).
3. Design and Construction of Sanitary and Storm Sewers, Manual of Practice No. 9, 1969. (Water Pollution Control Federation).
4. Operation of Wastewater Treatment Plants, Manual of Practice No. 11, 1970. (Water Pollution Control Federation).
5. Sewage Treatment, 1965. (K. Imhoff & G. H. Fair, Published by John Wiley & Sons, Inc.).
6. Water Pollution Control. (W.W. Eckinfelder & D.I. Ford, Published by The Pemberton Press).