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United Nations Industrial Development Organization

Training Course
Ecologically Sustainable Industrial Development

Learning Unit 9

Environmental Considerations in Project Design

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Further information may be obtained from:
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Additional Course Material

Video: *Paper Forest*, a film by UNEP

Introduction

Learning Unit 9 explains how to take environmental considerations into account when designing industrial development projects.

Objectives

The specific learning objectives of this unit are as follows:

- To recall priority environmental concerns that should influence the design of technical cooperation programmes and projects.
- To introduce publications that will help you assess the potential pollution problems created by industrial development.
- To describe UNIDO and UNDP guidelines that will assist you in introducing an environmental dimension systematically into technical cooperation projects.
- To practise incorporating environmental considerations into projects.

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Key Learning Points

1 There should be an environmental dimension in most technical cooperation projects.

2 UNIDO programmes and projects should support the recommendations of the Conference on Ecologically Sustainable Industrial Development and Agenda 21 (UNCED) as well as the UNIDO environment programme.

3 UNIDO projects should address the following immediate environmental priorities:

- Minimizing the industrial discharge of conventional water pollutants, common air pollutants and toxic chemicals.
- Reducing the use of fossil fuels.
- Avoiding the inappropriate siting of industrial activities.

4 Most of the pollution problems from industrial activity are well known and can be assessed with existing guidelines. These rapid assessments can help set priorities, particularly if they are combined with estimates of potential exposure and adverse effects on human health and the ecosystem.

5 The publication *Guidelines for Environmental Appraisal* prepared by UNIDO, provides guidance on introducing environmental considerations into the design and development of UNIDO-implemented projects.

6 The publication *Handbook and Guidelines for Environmental Management and Sustainable Development*, prepared by UNDP, provides basic environmental information that a general development practitioner should have and a set of operational guidelines that should be taken into account in formulating UNDP-financed projects.

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7 Long-term follow-up, monitoring and reporting are critical to ensure that projects adhere to environmental recommendations.

Suggested Study Procedure

1 Take the test in the *Review*. Think about the questions raised and what you need to learn from this Learning Unit.

2 Work through the *Study Materials*, including the *Reading Excerpts* and the video. Prepare answers to the questions and check your answers against those suggested.

3 Read the *Case Studies*. If possible, work with a small group to discuss the questions raised. Compare your answers with those suggested.

4 Complete the exercises in the *Review*.

Study Materials

Throughout this training course you have been introduced to a wide range of environmental considerations that you can now bring to bear on your project design. Learning Unit 9 first reviews many of the important environmental considerations that you should keep in mind when designing industrial development projects. It then introduces you to UNIDO and UNDP guidelines for the environmental appraisal of projects and provides you with some exercises to test your understanding of these guidelines.

Project Design

Your project may be a free-standing environment project, i.e. one that is designed particularly to address an environmental problem, or it may be an industrial development project that needs an environmental dimension integrated into it.

In either case, begin by making sure that your project addresses an environmental problem of concern, particularly a problem that results from industrial activity. There is a considerable amount of information available on environmental conditions in developing countries, some of which has already been mentioned in this course. In addition, government agencies and NGOs, particularly those agencies and organizations that deal with the environment, public health and safety and natural resources, will have information on local environmental problems. Finally, environmental profiles of specific countries have been prepared. They can be obtained from representatives of the countries and organizations listed in table 1.

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Review the proposed project elements to see how they fit into the following:

- The priorities of the UNIDO environment programme.

Table 1. Regional and National Environmental Assessment Studies[a]

Canada, Canadian International Development Agency. Environmental strategies: 10 countries.
Denmark, Department of International Development Cooperation. Environmental profiles: 5 countries.
Food and Agriculture Organization of the United Nations in cooperation with other United Nations agencies and institutions. Tropical forestry action plans: 75 countries.
Netherlands, Ministry of Foreign Affairs. Environmental profiles: 10 countries.
Permanent Interstate Committee for Drought Control in the Sahel. National plans to combat desertification: 6 countries.
United Kingdom. Environmental synopses: 12 countries.
United Nations Conference on Environment and Development. National reports: approximately 165 countries.
United Nations Environment Programme. Regional seas programme studies and reports: 45 countries.
United Nations Environment Programme and various national institutions. State of the environment reports: 42 countries.
United States Agency for International Development. Tropical forestry and biodiversity assessments: 35 countries.
United States Agency for International Development. Country environmental profiles: 62 countries.
United States Agency for International Development. Country disaster profiles: 49 countries.
World Bank. Environment action plans: 19 countries.
World Conservation Monitoring Centre. Biological diversity profiles: 48 countries.
World Conservation Union. National conservation strategies: 29 countries.

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[a] A considerable amount of information is being compiled on the environment in developing countries, often with the support of bilateral and multilateral donors and NGOs. This list, arranged alphabetically by sponsoring country or organization, mentions some of these reports and is indicative of the number of countries covered.

Source: Excerpted from T. Mathews and Daniel B. Tunstall, *Moving Toward Eco-Development: Generating Environmental Information for Decision Makers*, (Washington, D.C., World Resources Institute, 1991) and contained in UNDP, *Handbook and Guidelines for Environmental Management and Sustainable Development* (1992).

- The priorities set at the Conference on Ecologically Sustainable Industrial Development.
- Agenda 21.
- International agreements.
- General environmental priorities.

The UNIDO environment programme seeks to ensure the ecological sustainability of industrial development and to maximize industry's beneficial impact by minimizing its adverse environmental effects. To achieve this goal the programme is divided into four subprogrammes.

- Subprogramme I aims to enhance, by means of training, the internal capacity of UNIDO in environmental matters. This involves not only the strengthening of in-house expertise but also the identification of regional and sectoral expertise on a given problem.
- Subprogramme II seeks to address the problem in developing countries of insufficient experience in addressing environmental degradation. The objectives are to raise awareness of environmental issues and to enhance the capacity of developing countries in industry-related environmental impact assessments, the prevention of accidents and the formulation of environmental policies, standards and legislation.
- Subprogramme III emphasizes the prevention of industrial pollution as distinct from the alleviation of its effects. Activities under this programme include preparation of guidelines and manuals, demonstration projects, training and the dissemination of information.
- Subprogramme IV offers technical advice for pollution abatement, which cannot be ignored even if pollution prevention has a higher priority. There is still much to be done to improve the maintenance and operation of existing industrial plants.

Some UNIDO actions that will contribute to ESID were discussed in Learning Unit 3. They include assisting developing countries with:

- Research, technical support and training to build technical and scientific capacity for pollution prevention and Cleaner Production processes.

- Technical and fund-raising support to implement international environmental agreements.

- Industrial guidelines and technical support for measuring environmental impacts and determining the soundness of industrial technologies.

- Technical support to identify priorities and rehabilitation techniques aimed at integrating environmental considerations into industrial strategies and policies.

Agenda 21 is also discussed in Learning Unit 3. It sets priorities for industrial activity, including

- Integrating environment and development in decision-making (chapter 8): government policies to promote more appropriate production and consumption patterns, establishment of environmental accounting systems, effective legal and regulatory frameworks, effective use of economic instruments and market incentives.

- Protection of the atmosphere (chapter 9): develop less polluting sources of energy; more efficient energy utilization in the transport and industrial sectors; prevention of stratospheric ozone depletion; and reduction in transboundary atmospheric pollution.

- Protection of water resources: the oceans (chapter 17) and fresh water resources (chapter 18): reduce marine pollution, 70 per cent of which comes from sources on land; sustainable use and conservation of marine living resources; integrated water resources development and management; and protection of water resources, water quality and aquatic ecosystems.

- Environmentally sound management of toxic chemicals, hazardous wastes and solid wastes (chapters 19, 20, 21): establishment of risk reduction programmes; prevention and minimization of hazardous waste; maximization of waste reuse and recycling; and promotion of waste disposal and treatment.

- Business and industry (chapter 30): promotion of Cleaner Production, elimination of the inefficient use of resources, promotion of responsible entrepreneurship.

- Technology transfer (chapter 34): cooperation between companies in developed and developing countries, joint ventures between suppliers and recipients of technology, licensing agreements.

Some major international agreements address the priorities of Cleaner Production:

- The Montreal Protocol sets limits for ozone-depleting substances.

- The Basel Convention aims to control the transboundary movement and disposal of hazardous wastes.

- The Framework Convention on climate Change aims to stabilize greenhouse gases.

General environmental priorities include reduction of the following:

- Discharges of conventional water pollutants (organic matter and solids) that threaten water supplies and productive resources.

- Discharges of common air pollutants, e.g. suspended particulate matter and SO_2 and NO_X, that cause acute and chronic health problems, particularly in urban areas.

- The use of fossil fuels, through energy conservation and the application of renewable energy sources.

- Discharges of toxic heavy metals, e.g. chromium, mercury and lead, and aromatic chlorinated compounds, e.g. PCBs and dioxins, and, in the long run, their elimination.

- Solid wastes and their disposal.

They also include the location of industrial facilities away from sensitive ecological areas or heavily populated areas.

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If your project involves a specific industrial activity, you will need to assess its potential environmental problems. Learning Unit 5 discussed how to carry out a full environmental impact assessment; such assessments may be necessary, especially for large industrial projects. You can get a good preliminary idea of the potential problems from some of the following sources:

- The WHO publication *Rapid Assessment of Sources of Air, Water and Land Pollution* provides factors for estimating pollution from different industrial activities according to the level of output and the degree of pollution control in place. It describes how to apply these coefficients to estimate the magnitude of pollution that might be generated by a specific industrial activity.

- Two publications of the World Bank. The first, *Environmental Guidelines* (the year of publication was 1988, but the contents are based mainly on reports from the 1970s), describes industrial pollution problems for over 30 industries as well as several common air and water pollutants (see table 2). The second, *Occupational Health and Safety Guidelines* (also published in 1988, but based mainly on reports from the 1970s), covers health and safety issues for the same industries.

- The World Bank, UNIDO and UNEP are in the process of updating these guidelines to reflect the shift away from end-of-pipe treatment towards pollution prevention and waste minimization. A total of 85 guidelines are planned. As of November 1993, draft guidelines were ready for 20 sectors. Ten should be available for project staff by the end of 1993.

- The *Environmental Assessment Sourcebook* of the World Bank, in three volumes, covers a wide array of environmental topics; volume III describes the major environmental impacts of energy use in several industries (see table 3).

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As always, you must ensure that your project conforms to the general guidelines for project design prescribed by UNDP in its *Programmes and Projects Manual* and by UNIDO in its *Guidelines for Project Design*. For large projects (normally over $1 million), the project design can be preceded by an objectives-oriented project planning workshop that aims to ensure that projects are client-oriented, catering to their specific needs.

It is very important, of course, that you identify the source of funding for your project. UNIDO relies on three main categories of funding: UNDP funds, special trust funds and UNIDO- administered funds. Special funds for environmental projects are also available from the Global Environment Facility of UNDP/UNEP/ World Bank, the Multilateral Fund of the Montreal Protocol and Capacity 21 (see *Reading Excerpts*). The project approval process, including the environmental review, varies with the type of funding, so it is a good idea to identify the probable source of funding as early as possible in the project design stage.

Table 2. Scope of Coverage of the World Bank's Environmental Guidelines, 1988

Aluminium
Cane sugar
Cement
Chlor-alkali
Dairy products
Dust emissions
Earthquake protection
Effluents: disposal of industrial wastes
Effluents: liquid, land disposal and treatment
Electrostatic precipitators (ESPs)
Ethanol production
Fertilizer manufacturing wastes
Fish and shellfish processing
Fruit and vegetable processing
Geothermal development
Glass manufacturing
Iron and steel: general considerations
Iron and steel: blast furnace
Iron and steel: by-product coke ovens
Iron and steel: ore preparation, sintering and pelletizing
Iron and steel: rolling and finishing operations
Iron and steel: steel-making process
Lead sampling and analyses
Leather tanning and finishing
Meat processing and rendering
Mining: strip surface mining operations (sediment and erosion control — land reclamation)
Mining: underground (coal)
Nitrogen oxide emissions
Nitrogen oxide sampling and analyses
Noise
Non-ferrous metals: aluminium
Non-ferrous metals: copper and nickel
Non-ferrous metals: lead and zinc
Non-ferrous metals: silver, tungsten, columbium and tantalum
Offshore hydrocarbon exploration and production projects
Oil pipelines
Palm oil
Pesticide manufacture safety and ecology*
Pesticides guidelines for use*
Petroleum refining
Plating and electroplating
Plywood manufacturing
Poultry processing
Pulp and paper
Rodenticides*
Rubber production (crumb)
Secondary environmental effects
Slaughterhouses: industrial waste disposal and design arrangement
Sulfur dioxide ambient levels
Sulfur dioxide emission standards
Sulfur dioxide sampling and analyses
Tea and coffee production
Textiles and synthetic fibres
Wood scouring

** an asterisk denotes environmental and occupational health and safety guidelines*

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Table 3. Scope of Coverage in the World Bank Publication:
Guidelines for Environmental Assessment of Energy and Industry Projects[a]

Industrial hazard management	Cement
Hazardous materials management	Chemical and petrochemical
Plant siting and industrial estate development	Fertilizer
Electric power transmission systems	Food processing
Oil and gas pipelines	Small and medium-scale industries
Oil and gas development: offshore and onshore	Iron and steel manufacturing
Hydroelectric projects	Non-ferrous metals
Thermoelectric projects	Petroleum refining
Financing nuclear power:	Pulp, paper and timber processing
	Mining and mineral processing

[a] *Environmental Assessment Sourcebook*, World Bank Technical Paper No.154, vol. III.

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Next Steps

1 Read "Programme objectives: output and activities" and "Environment funding sources to be tapped by UNIDO", included in the *Reading Excerpts* at the end of this Learning Unit.

2 Test your comprehension of the information by answering the questions below. Compare your answers with those suggested.

Questions

1 Identify technical assistance activities that UNIDO could undertake under subprogrammes II, III or IV to assist developing countries meet the requirements of international environmental conventions and protocols.

2 Name some specific policy areas that UNIDO technical activities should address to promote ecologically sustainable industrial development.

3 Which UNIDO subprogramme encourages the preparation of guidelines?

4 What is the difference between subprogramme III and subprogramme IV?

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Answers

1. Under subprogramme II.5 (d), it could prepare guidelines related to compliance with international conventions and protocols; under subprogramme III.5 (e), it would disseminate information and undertake subprogramme IV.5 (c), it would identify and implement actions necessary to comply with the conventions and protocols.

2. Under subprogramme II.5 (e) (iii), ESII-related measures could be integrated into fiscal policies, financial and credit policies, regulation, technology policies and spatial location policies.

3. Under subprogramme I.4 (c), UNIDO could issues guidelines on pollution control, risk management, life-cycle analysis, environmental economics and environmental impact assessment.

4 Subprogramme II emphasizes the better use of human and natural resources as well as pollution prevention in preference to end-of-pipe solutions. Subprogramme 3 recognizes that end-of-pipe technologies are often necessary to reduce pollutant discharges to a satisfactory level.

Next Steps

1 Look over the questions below so that you have some idea of what you will want to learn from the video.

2 Watch the video *Paper Forest*.

3 Test your comprehension of the information by answering the questions below. Compare your answers with those suggested.

Questions

1 List some product life-cycle considerations identified by the video.

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2 What are the main pollutants associated with pulp and paper mills? What solution is proposed to minimize these problems?

3 Identify measures that the new mill can take to prevent pollution.

4 Why might you be sceptical that the new mill will manage its pollution problems? What innovative measure will the Government use to encourage pollution reduction?

5 Which negative effects have not been foreseen in the design of the mill?

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Answers

1. Products life-cycle considerations raised by the video are the necessity for paper products, the imports of raw material, use (water and wood), recycling of waste paper and an alternative source (biogas) of fuel to conserve wood for paper use.

2. The main pollutants are dissolved organic matter and suspended solids. The proposed solution to these problems is to install primary and secondary waste-water treatment.

3. The new mill can reduce water use and use black liquor waste as a source of fuel.

4. You might be sceptical because most existing mills are causing water pollution problems and the government appears to be powerless to address these problems. The government did expect that the water cess (tax) would provide a new incentive to control pollution.

5. For us wood suppliers, the new mill will rely on eucalyptus plantations which require large amounts of water. The eucalyptus monoculture will also impoverish the local ecosystem and reduce opportunities for hunting and gathering by villagers.

UNIDO Project Cycle Management: Environmental Considerations

Environmental issues must be considered in each of the six stages of the UNIDO project cycle: project identification, formulation/design, appraisal, approval funding, implementation/monitoring and evaluation.

Guidance for environmental consideration in the UNIDO project cycle is provided by the UNIDO *Guidelines for Environmental Appraisal*. The *Guidelines* are most useful at the stage of project design.

The *Guidelines* provide for two classifications of UNIDO technical cooperation projects:

- Category A projects are those that do not involve capital investment, for example, human resource development or industrial management projects. Approximately 90 per cent of new UNIDO projects are category A projects.

- Category B projects are those that do involve capital investment, for example, plant expansions, process modifications or the introduction of waste management facilities including treatment plants, disposal sites and laboratories. Approximately 10 per cent of new UNIDO projects are category B projects.

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Because category A and category B projects have different environmental implications, the *Guidelines* provide separate analysis procedures and check-lists for each. In addition, special check-lists are provided for four industries: tanneries and leather finishing, iron and steel manufacturing, fertilizer manufacturing and food and agro-industries.

For category A projects (no investment), the *Guidelines* take the user through several steps to ensure that environmental measures are integrated into the project. The procedure focuses on environmental awareness and the development of technical and institutional capability. UNIDO staff are expected to consider the following key questions:

- Does this project promote environmental awareness?

- Is training in environmental matters included?
- Is environmental information management included?
- Has institutional strengthening been considered?

For category B projects (investment), the *Guidelines* take the user from the sources of environmental impacts, to the receptors of impacts, to assessment of the significance of the impacts and, finally, to mitigation measures. The procedure examines various stages of the industrial process, highlighting

- Sources of pollutants.
- Points where environmental impacts are likely to occur (receptors).
- The actual environmental impacts (water, air, soil, land use) and their significance.
- Measures to mitigate environmental impacts.

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Next Steps

1 Read the selection from *Guidelines for Environmental Appraisal*, included in the *Reading Excerpts* at the end of this Learning Unit.

2 Test your comprehension of the information by answering the questions below. Compare your answers with those suggested.

Questions

1 How would you define a category A project? List a few examples of such projects.

2 What type of environmental measures might you introduce into category A projects?

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3 How would you define a category B project? List a few examples of such projects.

4 List some sectors where one would expect to find significant environmental impacts.

5 How would you define a significant environmental impact?

6 What would be your first priority in thinking about mitigation measures?

Answers

1. Category A projects are technical assistance projects with no capital implications, i.e. no requirements for investments to build, expand or modify a plant. Examples of category A projects are human resources development, industrial management and industrial planning and strategies

2. Potential measures are the promotion of environmental awareness by: distributing environmental information and by instituting international experts to discuss environmental matters with the national counterparts, incorporation of environmental training as one activity in the project, and discussing on the IVTIR database for environmental information about a specific topic.

3. Category B projects are technical assistance projects with potential primary or secondary environmental impacts. These are normally projects with capital implications, i.e. investment is required for construction or expansion of the industrial plant, process modification or introduction of waste management facilities. Examples of category B projects are energy feasibility studies, industrial rehabilitation and maintenance.

4. Some potential sectors are metal finishing, which discharges toxic metals, coal combustion, which discharges acidifying pollutants, pulp and paper manufacturing, which discharges large volumes of organic matter, and cement manufacturing, which discharges large volumes of particulate matter

5. (Criteria for a significant environmental impact include exposure of a large number of people, potential to adversely affect drinking water supplies or disrupt productive farming and fishing activities and location near sensitive ecological areas.

6. You would consider (Cleaner Production options (different raw materials, reduce water use etc.) before waste treatment and disposal technologies.

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UNDP Programme/Project Management: Environmental Considerations

Guidance for environmental considerations in the UNDP project cycle is provided by the UNDP *Handbook and Guidelines for Environmental Management and Sustainable Development*, which is available at any UNDP office.

UNDP sees its approach as different from existing environmental guidelines because it focuses on the front end of development work, i.e. the planning and implementation of technical assistance and the pre-investment phase, rather than on problem identification and environmental assessment. Thus, its *Guidelines* do not follow the environmental impact assessment route. They endeavor, rather, to be proactive in orientation.

The UNDP *Guidelines* consist of three parts:

- General concepts of environmental management and sustainable development.
- Operational guidelines that assist in introducing an environmental dimension into all UNDP technical cooperation activities.
- Annotated bibliography of environmental impact assessment and environmental management guidelines.

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The UNDP *Guidelines* identify environmental checkpoints, or key activities during which environmental management tools ought to be incorporated. These checkpoints include

- The programming of technical assistance, e.g. round table consultations.
- The country programme cycle: review of the existing country programme; advisory note; resource assessment; review by the Programme Appraisal Committee and the Action Committee; implementation; and monitoring and evaluation.
- Programmes and the project cycle: programme/project identification; project formulation; screening proposed projects, revision following project appraisal; project

approval; project implementation and project monitoring and evaluation.

UNDP prescribes four environmental management tools to be used at the various checkpoints:

- Tool 1, an environmental check-list, serves as a reminder of the key questions to be answered in assessing a programme or project.

- Tool 2. an environmental overview, is a short document providing basic environmental information and alternatives /modifications to increase the sustainability of a development alternative. Environmental overviews can be prepared for a country programme (EOC) or for a programme or project (EOP).

- Tool 3, an environmental screen, consists of criteria for screening the project from an environmental point of view.

- Tool 4, an environmental management strategy, is a detailed, action-oriented environmental plan prepared for a UNDP project. Whereas environmental overviews simply examine what might happen to the environment with a proposed UNDP project, an environmental management strategy identifies what must be done to mitigate the environmental disturbance, designates who must do it and when, and describes what resources will be required. An environmental management strategy is an ongoing effort demanding close UNDP monitoring throughout the project life cycle.

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Next Steps

1 Read "Operational guidelines", included in the *Reading Excerpts* at the end of this Learning Unit.

2 Test your comprehension of the information by answering the questions below. Compare your answers with those suggested.

Questions

1 What is the difference between an environmental overview of a project and an environmental management strategy?

2 At what stage in the project cycle is one required to prepare an environmental overview of a country programme? At what stage in the project cycle is one required to prepare an environmental overview/management strategy?

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3 What types of programmes/projects should be subject to further environmental consideration?

4 The UNDP *Guidelines* recommend that infrastructure and industrial strengthening projects be subject to further environmental considerations, including those with risks of accidents. In what sector is there the greatest potential for accidents?

5 What type of questions should be addressed in an environmental management strategy (EMS or EOP/MS)?

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Answers

1. An environmental overview of a project describes what is happening or might happen to the environment with a proposed action. An environmental management strategy identifies specific mitigation measures, when they will be carried out, who will undertake them, when will they be implemented and what resources are needed to implement them.

2. An environmental overview of a country programme should be prepared at the advisory note formulation stage and, where necessary, an environmental overview management strategy should be prepared at the project formulation stage.

3. The five types are environmentally sensitive areas or activities: livestock, farming and fishing practices; activities dealing with water resources; infrastructure and industrial strengthening; and urbanization, land development and waste management.

4. The chemical sector.

5. Questions include how to mitigate disturbance, when will mitigation activity take place, who is responsible for implementing action, how long it will take to implement action and what is required to carry out action

Additional Suggested Readings

This concludes the study section of Learning Unit 9. For additional information on environmental considerations in project design, you may refer to the following sources.

Economopoulos, A.E. *Assessment of Sources of Air, Water and Land Pollution*, Environmental Technology Series (Geneva, WHO, 1993). *Part One: Rapid Inventory Techniques in Environmental Pollution* and *Part Two: Approaches for Consideration in Formulating Environmental Control Strategies.*

Environmental Resources Limited. "Environmental assessment procedures in the UN system", Report prepared for UNEP, 1990.

Finland, Department of International Development Cooperation. *Guidelines for Environmental Impact Assessment* (Finnish International Development Agency, 1989).

UNIDO, "First guide for UNIDO officers in evaluating the environmental impact of industrial projects". (PPD.76 (SPEC.)).

World Bank, Environment Department, *Environmental Assessment Sourcebook*, Volume I: Policies, Procedures, and Cross-Sectoral Issues, Technical paper No. 139, Volume II, Sectoral Guidelines, Technical paper No. 140; Volume III, Guidelines for Environmental Assessment of Energy and Industry Projects, Technical paper No. 154 (Washington, D.C., 1991).

World Bank, *Environmental Guidelines* (Washington, D.C., 1988).

World Bank, *Occupational Health and Safety Guidelines* (Washington, D.C., 1988).

Case Studies

Next Steps

1 Familiarize yourself with the draft pollution prevention and abatement guidelines for cane sugar processing and refining in the *Reading Excerpts*. Then read the short hypothetical case below and answer the questions that follow, if possible working in a small group.

2 Compare your answers with those suggested.

Case Study 1: Industrial Rehabilitation of Sugar Processing Plants

As a result of a UNIDO preparatory mission, you have received a project document calling for a complete diagnosis of the cane sugar industry in a developing country. The project will address the overall efficiency and profitability of the 20 mills that are currently operating below capacity and at a financial loss.

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After reviewing the project document, you decide, based on the UNIDO *Guidelines for Environmental Appraisal*, that it has capital implications (category B) and that it must be expanded to address environmental and energy issues. Consult the excerpt on cane sugar processing and refining and, if available in your office, Section III-D, "Food-agro industries", of the UNIDO *Guidelines for Environmental Appraisal* to answer the following questions that must be addressed in the background section in the project document and to prepare terms of reference for an environmental expert.

Questions

1 What environmental problems need to be addressed?

2 What pollution prevention measures would you recommend that the environmental expert should consider?

3 What by-products would you suggest that the expert should consider for recovery?

4 What air pollution prevention measures should the expert consider?

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Answers

1. The primary environmental problem is waste water that is produced throughout the production process. For mechanically harvested cane, water demand during the initial cleaning is particularly high. Other environmental problems are suspended particulates from the combustion of bagasse, fuel oil or coal; solid waste produced during the initial mechanical operation; and fugitive dust from granulation operations.

2. Water conservation through recycling and reuse should be the major area to examine. The sulphitation clarification process, which processes a high pollution load, can be replaced by the Talo-floc process, or by the use of bentonite, double centrifugation or affination. The fermentation of sugarcane juices can be averted by appropriate straining, by the systematic application of disinfectants or biocides in mill juices and by systematic cleaning when the milling has stopped.

3. The expert should consider boiler and fly ash; bagasse; filter mud; molasses and residual waters for irrigation.

4. Flue gas emissions can be reduced by controlling combustion, air pressure and the rate of excess air.

Case Study 2: Coastal Area Development

Next Steps

1 Read "Environmental overview of project and management strategy for a sample UNDP project" in the *Reading Excerpts*.

2 Answer the questions below, if possible working in a small group.

3 Compare your answers with those suggested.

Questions

1 What major environmental impacts are associated with the implementation of the project?

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2 What potentially significant environmental impact was not mentioned?

3 What additional environmental policy would help to mitigate the excessive use of pesticides?

4 As a proponent of industrial development, what would you like to see included in this project?

5 If the project were to include a feasibility study for processing cocoa, what potential environmental impacts should be addressed in the environmental management strategy? (Hint: Many agro-industries have similar environmental problems; refer to the guidelines for cane sugar).

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Answers

1. Major environmental impacts might include the following:
Disruption of the nutrient level in the ecosystem due to the shift to monoculture.
Population migration that would degrade the existing resource base.
Adverse health effects

2. There is no mention of the effect in the aquatic ecosystem of increased pesticide use for estate cocoa and coffee. In other estate crop areas of Indonesia, the aquatic ecosystem has been disrupted by the intense use of pesticides.

3. The Government could stop subsidizing pesticide use. If the price of pesticides were higher, farmers would be restrained in their use of pesticides.

4. The project did not support the processing of the coffee and cocoa beans. This processing would generate additional wealth and employment for the people. Additional processing might also be possible for the fishery industry.

5. The potential environmental impacts of cocoa processing include the following:
Waste water is generated in the washing operations and in roasting plants that employ wet-stack scrubbers
Solid waste is produced during crushing and grinding
Roasting operations release SO_2 and particulates into the atmosphere.

4 Which chapter of Agenda 21 addresses Cleaner Production?

a. Chapter 34, "Technology transfer"
b. Chapter 30, "Business and industry"
c. Chapter 9, "Protection of the atmosphere"
d. Chapter 8, "Integrating environment and development in decision-making"

5 Which United Nations organization has prepared guidelines for the rapid assessment of sources of air, water and land pollution?

a. WHO
b. UNIDO
c. UNEP
d. UNDP

6 Which of the following is not a special source of funds for environmental projects?

a. Global Environment Facility
b. Basel Convention
c. Capacity 21
d. Multilateral Fund of the Montreal Protocol

7 The UNIDO guidelines are most useful at which stage of the project cycle?

a. Design
b. Identification
c. Approval
d. Evaluation

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8 All of the following might be appropriate environmental measures for projects *without* capital implications except

a. Environmental awareness
b. Technology change
c. Training
d. Information mangement

9 UNIDO projects that require no capital investment (category A) constitute approximately what per cent of UNIDO tachnical assistance?

a. 90 per cent
b. 70 per cent
c. 50 per cent
d. 30 per cent

10 All of the following measures might be appropriate environmental measures for projects with capital implication except

a. Information management
b. Good housekeeping
c. Process changes
d. Treatment snd disposal of wastes

11 The UNDP *Handbook and Guidelines for Environmental Management and Sustainable Development* focuses on

a. Identifying environmental problems
b. Assessing environmental impacts
c. Designing environmental management agencies
d. Planning technical assistance

12 The environmental overview required by the UNDP *Guidelines* can be prepared for

a. A country
b. A project
c. A programme
d. All of the above

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Answers

1-5 b d c b a

6-10 b a b a a

11-12 d d

Some Ideas to Think About

Use a recently completed category A (no capital investment) project that you know well to think about the following questions. Take some time to think about them. If possible, work in a small group and try to achieve consensus.

1 What were the potential environmental impacts?

2 How could the *Guidelines for Environmental Appraisal* have helped to identify adverse environmental impacts?

3 What appropriate mitigating measures did you suggest in terms of awareness, training, institution building or environmental management information systems?

4 To what extent were the measures cost-efficient and to what extent were they effective?

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5 What were the barriers and difficulties for addressing environmental concerns in that particular project? How could they be approached in the future?

Reading Excerpts

Programme Objectives: Output and Activities

Excerpted from "UNIDO environment programme", (IDB. 10/17), chap. IV.

The proposed programme comprises four subprogrammes which together address the priorities outlined.

Subprogramme I	Enhancing the organization's capacities in rendering ESID-related assistance
Subprogramme II	Integrating environmental considerations in developing countries' industrial development strategies and policies
Subprogramme III	Promotion of Cleaner Production
Subprogramme IV	Technical cooperation in pollution abatement

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Subprogramme 1: Enhancing the Organization's Capacities in Rendering ESID-Related Assistance

Problem to Be Addressed

There is a growing need for UNIDO to deliver increasingly diversified ESID-related assistance to developing countries. It is therefore essential that staff knowledge be continuously upgraded in such areas as environmental and energy policy, technology, information and funding sources and that that information be incorp ated in the development, appraisal, implementation and evaluation of all UNIDO programmes and activities.

Objective

To continue to enhance, through training and recruitment, UNIDO's capacity to provide effective ESID-related assistance, applying the latest solutions based on the recommendations of the ESID Conference.

Subprogramme Focus

UNIDO Secretariat and field staff, United Nations and other international organizations and development agencies, counterpart staff in developing and other countries.

Outputs

- Effective ESID-related assistance provided by trained UNIDO staff to developing countries, particularly in the areas of Cleaner Production, environmental and energy policy, information and funding sources, and capability of designing, appraising, implementing and evaluating technical cooperation and investment promotion based on the same principles;
- Enhanced capacity to prepare technical cooperation, investment and other projects supported by national authorities for submission to international funding authorities including, *inter alia*, those set up to help implement international environmental conventions and protocols;
- Manuals, handbooks, guidelines and other documented material on pollution control, risk management, life-cycle analysis, environmental economics, environmental impact assessment and other fundamental issues pertaining to sustainable industrial development for use by UNIDO and national counterpart staff;

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- Promotional material prepared on a regular basis which presents the work of UNIDO in support of ESID in developing countries;
- Environmental issues fully integrated into all activities which address major themes of the UNIDO medium-term plan.

Activities

- Continuation of seminars and training courses for headquarters and field staff on, *inter alia*, Cleaner Production, energy efficiency and conservation, ESID policy and strategy formulation, environmental economics, and pollution monitoring and control;
- Integration of environmental management guidelines into all stages of the UNIDO project cycle; incorporation of methodologies for environmental impact assessment into feasibility and pre-investment studies; promotion of tools demonstrating economic and financial advantages of environmental protection and rehabilitation; continuous updating, further development and

dissemination of the UNIDO Industrial and Technological Information Bank information networks and databases;

- Collection and dissemination to UNIDO staff and national counterparts of information on priorities of and access to funding sources for ESID;
- Preparation of written materials on fundamental issues pertaining to ESID for use by UNIDO and counterpart staff in designing and implementing technical assistance, investment promotion and other UNIDO projects;
- Preparation of bulletins, reports, speeches, lectures, press statements, letters, books, prefaces and other public statements and presentation material for use in promoting the work of UNIDO in support of ESID;
- Incorporation of energy, gender, economic and technical cooperation among developing countries (ECDC TCDC) technology and other areas emphasized in the UNIDO medium-term plan, including the promotion of regional and subregional cooperation, into all ESID programmes and projects.

Subprogramme II: Integrating Environmental Considerations in Developing Countries' Industrial Development Strategies and Policies

Problem to Be Addressed

Developing countries could make a decisive contribution to preventing and controlling industrial pollution within their own borders and at the global level. Yet, many developing countries lack sufficient experience to deal with environmental problems, as well as the necessary institutional infrastructure to appraise the environmental impact of industry and develop policies, norms, standards, regulations, legislation and market-based measures that would contribute to sustainable industrial development

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Objective

To enhance capacities of developing countries in the formulation of policies and strategies, in particular with regard to industry-related environmental standards and regulations combined with appropriate market-based measures, and in conduct of industry-related environmental impact assessments and accident prevention. The successful achievement of this objective would necessitate close collaboration with other multilateral, bilateral and regional organizations active in the field.

Subprogramme Focus

- Industrial subsectors: metallurgical and metal-finishing industries, pulp and paper, cement, textiles and tanneries, food-processing and chemical process industries, with due priority given, as stated in General Conference resolution GC.4/Res. 18, to the five subsectors that were highlighted at ESID, with particular attention throughout to energy sources and use.
- Environmental issues that transcend geographical and subsectoral boundaries such as industrial restructuring (scale, siting, mix of production), technological options, internalization of the cost of environmental protection in price calculations, industrial emissions, primarily from energy generation (NO_x, SO_2 and SO_2), ozone-depleting substances and hazardous waste.

Outputs

- Guidelines, methods and manuals produced and advisory projects implemented on environmental impact assessment, accident prevention techniques and management, environmental risk management and hazardous waste management; for plants and/or subsectors at the national, subregional, regional and international levels;
- Guidelines on ESID-based legislation, standards, regulation, monitoring, and development and application of market-based measures, including contingency plans for the industrial subsectors listed above;
- Advisory projects implemented to provide options to Governments in formulating sectoral policies, using an appropriate mix of regulatory and market-based measures, to promote industries that contribute to ESID using clean and low-waste technologies;
- Training programmes implemented to train developing country cadres in environmental planning for industry (in particular, environmental impact assessment and monitoring) and in formulation of industry-related environmental norms, standards, regulations, legislation and market-based measures.

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Activities

- Conducting of studies on environmental impact, alternative technologies available to alleviate that impact, in addition to the environmental protection norms and standards employed in industry in various parts of the world;
- Preparation of environmental protection guidelines and occupational health and safety regulations related to industry, in cooperation with other United Nations organizations and agencies;

- Continuous updating of the UNIDO system of databases, preparation and dissemination of guidelines, manuals and methods for introducing accident-prevention techniques and methodologies in industrial enterprises, and for safe disposal of hazardous waste, in cooperation with other United Nations agencies;
- Preparation of guidelines related to compliance with international environmental conventions and protocols, environmental standards, regulations and monitoring for the priority subsectors, in cooperation with other United Nations organizations;
- Implementation of ESID-based technical advisory projects which include the following:
  - Review of current and planned sectoral policies, policy instruments, strategies and institutional infrastructure;
  - Proposal of measures for integrating ESID into regional industrial policies, in accordance with national priorities and with due consideration for the incidence of those policies (national and regional);
  - Integration of ESID into specific areas such as fiscal policies, financial and credit policies, regulatory policies, technology policies, spatial/location policies, transboundary regulations and policies, and environmental auditing;
  - Encouragement of ESID through research and development, acquisition and transfer of technologies;
  - Promotion of education, public awareness, and information exchange on ESID policies, strategies and guidelines;
  - Establishment and/or strengthening of environmental impact assessment mechanisms to achieve qualitative and quantitative assessment of environmental impact of industrial activity;
  - Construction of information management systems for acquisition and organization of data on sources and effects of industrial pollution;
  - Assessment and protection of the impact of alternate ESID strategies on such socio-economic indices as population growth, income disparities, spatial variations in development and resource demands;
  - Strengthening of institutional capabilities to achieve ESID through expert advice and on-site training with special emphasis on the promotion and involvement of local organizations;
- Formulation and implementation of training programmes for developing country cadres in environmental planning, monitoring, modelling, auditing and impact assessment and in formulation of industry-related environmental norms, standards, regulations and legislation

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Subprogramme III: Promotion of Cleaner Production

Problem to Be Addressed

In the long run, as the UNCED and ESID conferences made clear, Cleaner Production, which emphasizes better use of human and natural resources and pollution prevention rather than end-of-pipe solutions, is more economical and conducive to sustainable development. Furthermore, in some instances, the use of cleaner technologies may actually prove more profitable to the firm. In the case of energy, greater benefit is derived from improvements in energy efficiency than from investments in pollution control. Furthermore, improved energy efficiency offers potential for reducing the emission of a broad range of pollutants. The critical gap in that respect, however, is the lack of information on technological options or the methods available to transfer them to enterprises in and Governments of developing countries.

Objective

To support the adoption of Cleaner Production, based on ESID, in the industrialization of developing countries.

Subprogramme Focus

Industrial subsectors: metallurgical and metal-finishing industries, pulp and paper, cement, textiles and tanneries, food-processing and chemical process industries, with due priority given, in accordance with resolution GC.4/Res.18, to the five subsectors covered by the ESID Conference, with particular attention throughout to energy sources and use.

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Outputs

- Advisory projects implemented providing technological information to Governments and/or entrepreneurs on the identification, assessment, acquisition and transfer of appropriate Cleaner Production technologies, including potential for ECDC/TCDC, conducted within the industrial structure and environment of the requesting developing countries;
- Pre-investment and feasibility studies undertaken to assess the economic viability and potential macroeconomic and micro-economic savings of Cleaner Production technologies over traditional solutions;
- Technical cooperation projects implemented that employ Cleaner Production technologies;
- Expanded information systems within UNIDO and in appropriate developing country institutions on Cleaner Production technologies based on ESID, including those required for com

pliance with international environmental conventions and protocols (for example, non-CFC technologies

- Information on appropriate, including new, financial resources, where possible on concessional terms, that would enable developing countries to have improved access to Cleaner Production technologies;
- Expanded roster of experts and database on institutional facilities providing training in the environmental upgrading of existing industries;
- Improved demonstration and training centres at new or existing industrial facilities and at centres of excellence where research and development suited to local industrial needs and capabilities will be strengthened;
- Cadres of developing country counterparts, trained to evaluate options and incorporate Cleaner Production technologies as appropriate in their industrialization processes.

Activities

- Assistance to developing countries in the identification, assessment, acquisition and transfer of pollution prevention techniques and Cleaner Production processes essential to making the transition to ESID, including potential for ECDC/TCDC;
- Demonstration of the financial and economic advantages and environmental benefits of ESID by undertaking pre-investment and feasibility studies;
- Provision of technical support for the design, establishment, operation, evaluation and monitoring of pollution prevention technologies and Cleaner Production processes and technologies; LU9
- Assistance to developing countries in contract negotiation and transfer of environmentally sound technology;
- Strengthening existing UNIDO databases and the Organization's capacity to coordinate the dissemination of technical and policy information on ESID, including relevant information on international environmental conventions and protocols;
- Assisting developing countries in identifying appropriate, including new, financial resources, where possible on concessional terms, that would enable them to take necessary steps to achieve ESID;
- Identifying experts, institutes and training facilities and promoting their inclusion in existing UNIDO industrial information systems and in appropriate institutions in developing countries;

- Establishment of demonstration and training centres at newer existing industrial facilitates, and providing support to centres of excellence;
- Training of developing country counterparts to enable them to evaluate options and incorporate Cleaner Production technologies into their industrialization process s.

Subprogramme IV: Technical Cooperation in Pollution Abatement

Problem to Be Addressed

Owing to social and economic circumstances, it is often not possible to implement Cleaner Production all at once by adopting sweeping ESID strategies and technologies in the manner outlined in subprogrammes II and III above. Instead, in particular where heavily polluting, often outdated, industrial facilities already exist, it can be more economical to curb pollution rather than investing heavily to eliminate it altogether. Industrial upgrading and industrial rehabilitation selectively employ ESID technologies to contribute to pollution abatement, saving scarce resources by increasing efficient resource utilization, in particular energy, and reducing environmental degradation, especially that caused by hazardous waste.

Objective

Building on extensive UNIDO experience in industrial rehabilitation, to control and mitigate the adverse impact of industrial pollution in developing countries.

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Subprogramme Focus

- Industrial subsectors: metallurgical and metal-finishing industries, pulp and paper, cement, textiles and tanneries, food-processing and chemical process industries, with due priority given, in accordance with resolution GC.4/Res.18, to the five subsectors covered by the ESID conference, with particular attention throughout to energy sources and use;
- Pollution abatement technologies and methods relevant to more than one industrial subsector.

Outputs

- Improved maintenance, operation and upgrading of existing industrial plants, selectively employing the principles of ESID based on results of environment, energy and waste audits;

- Technical cooperation projects, including pilot or demonstration projects, implanted to assist Governments and enterprises to adopt/adapt selected ESID programmes for pollution control, energy saving and industrial waste recycling, including as part of efforts to assist them in complying with international environmental conventions and protocols;
- Upgraded databases and technical manuals on generic treatment, reuse, recycling and management operations for wastes, in particular hazardous wastes;
- Information on appropriate, including new, financial resources, where possible on concessional terms, that would enable developing countries to employ selected ESID principles in their pollution abatement efforts;
- Upgraded databases and guidelines for measures and methods of preventing industrial accidents and extending operational life of plant and machinery (non-destructive testing, monitoring of condition and remote sensing), as well as guidelines for dynamic plant management;
- Expanded roster of experts in industrial pollution control;
- Training projects implemented on the handling, treatment and disposal of industrial wastes, including the selection of repository sites and related monitoring systems.

Activities

- Development and implementation of technical cooperation projects related to the maintenance, operation, upgrading and rehabilitation of industrial plants in order to reduce their environmental impact and energy consumption per unit of output;
- Development and implementation of technical cooperation projects, including pilot and demonstration projects, showing the efficacy of employing selected ESID pollution control, energy saving and industrial waste recycling programmes;
- Assistance in the implementation of international environmental conventions and protocols, by providing technical cooperation to help countries identify and implement the actions needed, as well as helping them to locate expertise and funding;
- Development of technical manuals and databases that address issues related to the design, function and efficiency of treatment operations for industrial wastes, as well as guidelines and methodologies for accident prevention techniques;
- Development of standards and guidelines for the safe disposal of industrial, including toxic and hazardous, wastes in cooperation

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with other governmental and non-governmental organizations, Governments and industry;

- Assistance to developing countries in identifying appropriate, including new, financial resources, where possible on concessional terms, that would enable them to take necessary steps to undertake pollution abatement measures based on ESID principles;
- Further development of information systems for the exchange of technological information, research and development and experience in managing industrial wastes.
- Identification of experts for the expanded roster;
- Development and implementation of training projects on the handling, treatment and disposal of industrial wastes, including the selection of repository sites and related monitoring systems.

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Environment Funding Sources to be Tapped by UNIDO

This text was prepared by the Environment Coordination Unit of UNIDO.

Global Environment Facility

Overview

The Global Environment Facility (GEF) is a pilot programme for helping developing countries to contribute towards solving problems in pre-specified areas of global concern. Initially funded for three years, (mid-1991 to mid-1994), the Facility provides the incremental capital costs associated with environmental protection, technical assistance, and to a lesser extent, research aimed at protecting the global environment and transferring environmentally benign technologies. The Facility's work falls into four main areas: prevention of global warming, protection of international waters, protection of biological diversity, and prevention of further depletion of the stratospheric ozone layer.

The aim of the GEF is to select projects (country and multicountry) which benefit the global environment, as distinct from the local environment. In addition, projects financed by the GEF must be innovative and demonstrate the effectiveness of a particular technology or approach to environmental protection. Given its pilot nature, other criteria include the contribution a project makes to human development and the extent to which project results can be definitively evaluated and disseminated.

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All IPF receiving countries with a per capita income of US$ 4,000 or less are eligible for GEF funds. Governments in developing countries are the primary agents in identifying and selecting projects, but they may seek assistance in project identification from the GEF's implementing agencies. All projects require government endorsement. GEF technical assistance projects are limited to US$ 10 million; GEF components of investment projects cannot be higher than US$ 30 million.

Responsibility for managing the programming of the GEF is shared by UNDP, UNEP and the World Bank. UNDP is responsible for technical projects and the World Bank for investment projects. The GEF is an administrative umbrella. The 'core fund' is approximately US$ 775 million. As of end of 1992, US$ 700 million of the 'core fund' will have been programmed. This means that the balance for 1993 is minimal unless the GEF is replenished, which is likely.

Montreal Protocol

Overview

In September 1987, the Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in Montreal, Canada. The parties adopted some adjustments to tighten the schedule for phasing out the ozone-depleting substances at their 2nd Meeting in London in 199[illegible]. The amendment established a Multilateral Fund to provide resources to assist developing countries to phase out the ozone depleting substances. The Fund operated from 1 January 1991 as an Interim Multilateral Fund. The 4th Meeting of the Parties, in November 1991, decided to transform the Interim Multilateral Fund to the Multilateral Fund to be effective as of 1 January 1993.

The Fund is managed by the 14-member Executive Committee established by the Parties. The Committee has a balanced representation of Parties from industrialized countries and developing countries that can receive assistance from the Fund as specified in Article 5 of the Protocol. The Committee is assisted by the Fund Secretariat based in Montreal, Canada. Projects and activities are undertaken mainly through implementing agencies, which are the World Bank, UNDP, UNEP and UNIDO.

As at end October 1992, a total of US$ 93 million had been contributed to the Fund. Out of this amount US$ 64 million have been disbursed. A developing country eligible for assistance is defined by paragraph 1 of Article 5 as a developing country whose annual calculated level of consumption of the controlled substances does not exceed 0.3 kg per capita.

UNIDO became an implementing agency in October 1992. A detailed work programme for 1993 was approved at the Ninth Meeting of the Executive Committee in March 1993 in Montreal. The focus of UNIDO activities will be at plant level investments to reduce the use of CFCs.

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For additional information, you might wish to contact:

United Nations Multilateral Fund for the implementation of the Montreal Protocol
1800 McGill College Avenue
Montreal Trust Building
Montreal
Quebec H3A3JC
Canada
Telephone: (514) 282 1122
Fax: (514) 282 1068

or

United Nations Industrial Development Organization
P.O. Box 300
A-1400 Vienna, Austria
Telephone: 21131-0
Fax: 232156

Operational Guidelines

Excerpted, with permission, from UNDP. *Handbook and Guidelines for Environmental Management and Sustainable Development* (New York, 1992), part II, pages 30-39.

Environmental Management Tools

Four management tools to be used at each step of UNDP operations are discussed in this section.

In addition, environmental documents and related reference materials are now being produced in copious amounts. As many of these materials could be used to prepare Environmental Overviews and Management Strategies, a library-style reference system on the environ- ment could be set up in each field office. That is, environmental infor- mation arriving at UNDP field offices could be categorized and collected in one place for staff members to be able to consult and retrieve. Field offices that already have libraries could set up sections on the environment and encourage Programme Officers to forward all appropriate documents to this facility.

Field office environmental focal points may also assist offices in assuring that environmental management processes are completed as outlined here and that environmental information flowing into the office is disseminated to the appropriate staff members, government counterparts and NGOs. Activities of the Sustainable Development Network and the Global Environment Facility should also be linked to the guidelines.

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Tool 1: Environmental Checklist for UNDP Technical Cooperation

To ensure that proper consideration has been given to the environment, a checklist serves as a reminder to those participating in activity implementation. (See Box 1.) These specific questions should be answered to facilitate the process of assessing whether the environmental dimension has been included.

Tool 2: Environmental Overviews

An Environmental Overview (EO) is an assessment tool that forms the basis for an Environmental Management Strategy. The aim of this short document is to provide basic information on the present environmental situation of a country or project. It will also include an assessment of how the environment might be altered if the programme or project is implemented. This tool is the simplest instrument, which can be used to determine whether a proposed activity is being designed and implemented

within an environmentally sound and sustainable approach. The EOs will be used in designing all UNDP activities.

All Environmental Overviews should:

- identify the main environmental opportunities and constraints that the implementation of the programme or project could bring about;
- suggest alternatives to the programme/project design that would take better advantage of potential environmental opportunities and/or mitigate likely environmental disturbances associated with the programme/project; and
- identify areas of uncertainty regarding modifications to the environment, as well as those potential social and economic conflicts that might arise if environmental changes are introduced in the programme/project area.

Whether the overview is prepared for a Country Programme or for specific projects and programmes, it should not be longer than seven pages. Box 2 (Preparation of Environment Overviews for UNDP Country Programmes [EOCs]) and Box 3 (Preparation of Environmental Overviews for UNDP-sponsored Projects and Programmes [EOPs]) contain annotated outlines of what to include in each type of overview. Only Box 3 is included in this reading excerpt.

The responsibility of preparing EOs belongs to those who are proposing a programme or project and, when appropriate, should be included in the terms of reference. This would include UNDP staff, other UN agency professionals, government or NGO counterparts and outside experts.

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For the Country Programme, the EOC should be prepared at the same time the Advisory Note is being drafted. For a project or programme document, the EOP should be done before or while the Project Formulation Framework (PFF) is being drafted but not finalized. This leaves ample time to make revisions if necessary and to incorporate mitigation measures and other environmental considerations throughout the Note or PFF. Once the EO is prepared, some of the information it contains should be incorporated into appropriate sections of the Advisory Note (eventually the Country Programme) or the actual PFF (for example, justification, objectives and so forth). The EO should also be attached as an annex to the programme/project document so that it can be reviewed by the Project/Programme Activity committee (PAC) and the Action Committee (AC).

Generally speaking, EOs are not based on original research, although occasionally independent research might be necessary. EOs should be developed mainly from existing information contained in country environmental profiles such as those prepared by other international organ-

izations, academic institutions, bilateral donors and NGOs (for example, those of the World Bank and Interregional Development Banks, or the national reports prepared for the U.N. Conference on Environment and Development). New information should be generated only if no other details about the characteristics functions of the local environment are available. Participatory development techniques that take advantage of grass-roots knowledge will help improve the accuracy of EOs.

An EOP should in principle be prepared for all projects from forestry to education to management training. For projects that lack any environmental factors or potential environmental components, the EOP will be limited to one page of outline subheadings with an explanation in each case as to why it is not applicable. For projects that do not have detailed EOPs, the project document chapter on 'Special Considerations' will explain in brief that no EO was created because of the non-applicability of the topic. Very few projects will fall under this category, however.

UNDP staff should use the information contained in the document as an important input to the evaluation of the proposed programmes and projects. The EOC can influence, for example, the drafting of many sections of the Country Programme.

Box 1. Environmental Checklist for UNDP Cooperation

- Has an EOC/EOP been prepared for the programme/project?
- Does the programme/project document include explicit actions to prevent and conserve the environment?
- Have the sources of environmental impact (positive and negative) been properly identified in the programme/ project document?
- Does the programme/project document include environmental mitigation measures?
- Have the potential conflicts of interest been properly addressed in document?

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Tool 3: Environmental Screening of UNDP Activities Using EOPs

EOPs contain the necessary basic information to allow those who are designing or responsible for the proposed programme/activity to decide whether the activity deserves further environmental consideration. To facilitate this, box 4 provides five main reference points to screen UNDP proposed activities. These criteria are not comprehensive, but mainly serve

as a reminder for the environmental reviewer. EOPs will also be annexed to the Country Programme, and this will provide the basis for assessing the environmental performance of the programme or project over time.

After UNDP screens the EOPs, the following choices of actions exist:

- Given potential environmental opportunities and or the absence of negative environmental impacts, write the final document (incorporating the EOP) and submit it to the PAC and, if necessary, the Action Committee.
- Do not pursue the proposal further due to its potential negative impact on the environment.
- Request additional information, clarification regarding the environmental characteristics of the area where the proposed activity is expected to take place; demand elaboration of some aspects of the EOP or expansion of information regarding potential environmental impacts prior to crafting the final document.
- Introduce changes to the design presented in the PFF to eliminate or mitigate potential negative environmental impacts, or to make better use of opportunities.
- Recommend preparing an in-depth Environmental Management Strategy for the project document that would be referred to throughout the implementation of the activity.

If the screening process leads to a choice to provide UNDP support for the programme project under consideration, the EOP should be annexed to the project document.

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Tool 4: Environmental Management Strategies

An Environmental Management Strategy (EMS) is a detailed action oriented plan prepared for UNDP projects. Environmental Overviews answer the question 'what' is happening or might happen to the environment with a proposed action. Environmental Management Strategies answer the questions:

- 'how' (to improve the environment or mitigate its disturbance),
- 'when' (at what time, through the life of a project, this will be done),
- 'who' (will be accountable for implementing and monitoring environmental activities),
- 'how long' (before the results will be seen), and
- 'what is required' (in terms of experts, information, institutional and financial support) for integrating environmentally sound and sustainable development principles within a proposed development activity.

Box 3 Preparation of Environmental Overview of Programme (Project) and Management Strategy (EOP/MS) Annotated Outline for Tool 2 and Tool 4

Although the text of this EOP/MS refers to projects, it can also be used for programmes. This outline contains a 'menu' of possible topics that might assist staff members to develop EOPs. Thus the sections included here should be completed only when applicable (see also Annex III for a sample EOP and MS). Information can be presented sectorally rather than geographically if necessary. Linkages between sections should be identified.

1 Brief Description of the EOP/MS Environment of the Area of the Project (1 page maximum)

In general, this section is intended to provide all those who are participating in the development of a UNDP Project with basic general information on the physical characteristics of the environment in the area. The idea is to highlight any important aspect of the natural environment that might be a ***determinant*** in the design, appraisal, extension, approval and assessment of a proposed UNDP regional, national or local project.

Land and water ecosystems	Describes those types of land and water ecosystems that characterize the project area (such as plains, valleys, mountain ecosystems, rivers, lakes) and whether any of these are known to represent untapped environmental opportunities or areas of particular environmental concern. Includes information on climate if appropriate, such as when the project relates to specific types of agricultural production. In urban areas, describes briefly the relevant geographical features.
Living resources	Describes (1) the biological species (fauna and flora) in the project area that represent particular concerns and/or opportunities for the environment (for example, the unexploited potential of certain resources such as medicines that could be obtained from tropical forest species), (2) the socio-cultural context in the project area (population size, ethnicity, poverty and gender indicators, etc.).

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2 Main Environmental Issues in the Project Area (1 page maximum)

This section covers the three environmental issues that are most important in the area where the project will be implemented—whether, for example, the area is prone to flooding, there is an ongoing process of desertification, or the sustainable fish catch potential is smaller than present exploitation. Topics to consider might include quality of life of the local population, natural hazards, fragile ecosystems, role of children and women and over-crowding. Consultations with local population groups will improve the accuracy of this section.

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3 Economics and the Environment in the Project Area (1 page maximum)

This section generally discusses whether the prevailing economic situation in the project area will effect the environment. Lists any prevailing national or local economic policies and regulations in the project area that affect the quality of the environment. Any enforcement mechanisms that prevail in the project area to protect the local environment should also be included. General statements about the population's socio-economic situation may be added if not listed under 1 above.

4 Environmental Management in the Project Area (1 page maximum)

This section should describe the capacity of the people and institutions working in the project area to cope with their environmental problems, achieve appropriate environmental management and promote sustainable development.

Legal and regualtory	Describes whether there are explicit environmental policies and regulations in the project area and, if so, whether they have the enforcement mechanisms and appropriate technical and financial support to be effective.
Major environmental actors	Includes a brief description of the main environmental actors in the project area (government authorities, international organizations, private sector, NGOs, in- dividuals) and their objectives and strategies. Identifies possible conflicts among the actors if the proposed project is implemented. Consider whether women play an active role in all these groups and are able to make the necessary contributions, explain their role.
Technical and managerial capacity to deal with environmental issues	Describes generally the existing educational, technical and managerial capacity in the project area (within the public, private, NGO and academic sectors) to deal with the environmental issues relevant to the project. Special emphasis should be given to the presence and activities of grass-roots organizations working on environmental protection. The strength and resources of environmental institutions in the project area should be briefly assessed.

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5 Major Natural and Socio-Economic Impacts and Opportunitites Associated with the Project Implementation (1 page maximum)

Both these sections should incorporate the views of the affected population groups: participatory development techniques should therefore be used whenever possible.

Potential impacts on the natural environment	Identifies the potential impacts, both positive and negative, that the implementation of the project may have upon the natural environment. Identifies the three most important environmental impacts that the implementation of the project might bring about, and describes how the project *will address them*. If the project is on agroforestry, for example, indicates whether soil conservation, watershed management and appropriate selection of pesticides and fertilizers have been envisaged.
Potential socio-economic impacts	Lists the three most important potential benefits and costs to the socio-economic impacts environment that may result from the implementation of the project.

6 Alternatives for Project Design (1/2 page maximum)

This section will discuss the possibility of altering the project design (technology, project objectives and methodology of implementation) to take better advantage of the opportunities offered by the environment in the project area, and to mitigate and eliminate the environmental disadvantages that the project might create.

7 Identification of Environmental Objectives of the Proposed Activity (1/2 page)

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The EOP/MS should state clearly and succinctly the environmental objectives of the alternative. These must conform with the broader development objectives of the country and therefore might go beyond the particular activity's goals. If a proposed activity does not explicitly indicate any environmental objectives, UNDP staff should request that such objectives be identified.

For example, a project on animal husbandry might identify production targets but not explicitly include environmental objectives. If the proposed activity will introduce new technologies or exotic animal and plant varieties, relocate people or introduce new chemical products, the local environment will be affected. The strategy, in this case, will help identify and clearly design the *environmental objectives* of such an animal-husbandry project. Environmental objectives could include soil protection, plant conservation and integrated agricultural development.

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8 Identification of Conflicts of Interest

Some of the objectives pursued by different environmental actors might conflict. For example, the interests of companies that commercialize chemical fertilizers will conflict with activities aiming to promote organic fertilization. The EOP/MS must identify such conflicts of interest and devise possible alternatives to avoid them. In the previous example, an incentive might be proposed for the commercial chemical enterprise to sell other fertilizers (including organic) that will promote soil fertility without damaging the environment.

9 Formulation of an Operational Strategy

The most important action-oriented part of the EOP/MS is the formulation of an operational strategy that will allow the achievement of the environmental objectives and goals proposed by the EOP/MS. The strategy must be formulated by the staff proposing, designing or evaluating the activity in consultation with project participants.

Specific environmental targets to be achieved	Identifies specific environmental targets in addition to the main environmental policy objectives identified in Section 2. If the proposed activity entails manufacturing processes (such as tanneries or food processing) which generate waste, for example, specific environmental targets would be set such as reducing all waste emissions by 15% over a period of three years and installing interim measures.
Participants in environmental management	Identifies the objectives and strategies of the major actors related to the environment in the area where the proposed activity will take place.
Plan of activities and timetable	Identifies a number of activities that will lead to the implementation of the strategy. A timetable must also be formulated indicating when such activities are expected to occur, and who will be responsible for them. As the EOP/MS will eventually become part of either the programme or project document, the proposed environmental activities and timetable should be compatible with the overall activities and timetable of the Programme or Project. Relevant national and local activities and timetables should also be considered.

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Environmental information	Provides reliable and accurate environmental information as the basis for sustainable decision making while acknowledging that accurate environmental information is difficult to obtain, especially in developing countries. The EOP/MS might include efforts to obtain the most accurate environmental information relevant to the proposed activity or to initiate work that will generate the necessary information over an identified period.
Supporting needs:	Identifies the specific needs required for the successful implementation of the strategy. The needs to be identified include: • Education and training • Technical and managerial skills • Access to environmental data banks • Institutional support • Financial aspect The development and implementation of the EOP/MS requires technical and financial resources. Technical assistance might be needed from UNDP in order to develop the strategy and identify the resources required to carry it out.
Assigning implementation responsibilities	States clearly who will be accountable for implementing each one of the activities proposed within the strategy.
Decision making	Analyzes the environmental chain of command and responsibilities in the area where an activity is being considered. This analysis should not be restricted to the chain of command in the environmental field (ministry of the environment, forestry sector) but should include the other sectors of the economy that are intimately related to the environment such as industry, trade, health, and so on. The objective is to identify to whom suggestions and recommendations—indeed, the entire EOP/MS—would be addressed. It should also include what would be the most efficient way to influence the decision-making process to protect and enhance the environment.

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10 Monitoring the EOP/MS

Every UNDP-sponsored activity is monitored regularly to ensure that its stated objectives are being achieved in the time framework envisaged. As the EOP/MS will probably be incorporated into the programme or project document that describes the proposed activity, it should be monitored according to the procedures presented. Constant, cautious monitoring on as frequent a basis as possible, using specific success indicators for the points raised in the strategy will help guarantee that the objectives are achieved.

The main difference between an EO and an EMS is that the latter is an ongoing effort demanding close UNDP monitoring throughout the activity while the former is a more static undertaking completed during project formulation.

The EMS should be prepared by those proposing the implementation of a project: mainly government officials, NGOs, academic institutions and UN agencies responsible for implementation. Terms of reference will need to refer to the EMS preparation.

The EMS, as part of the EO/EMS, steps 7 to 10, will be prepared according to the specifications provided in box 3, using participatory development techniques to the greatest extent possible. The length of an EMS can vary greatly, so guidelines on the length of each section are not included. UNDP staff are responsible for ensuring that the EMS is prepared according to these guidelines. It is recommended that the proposed project executer undertake the technical coordinating responsi- bilities, using, as necessary, appropriate UN agencies and or other affiliated agencies or NGOs

The ideas expressed in the EMS eventually need to be incorporated into the objectives, activities, inputs, work plan and so on of the project or programme document. Special references should also be made to the EMS and, if necessary, a specific section summarizing the EMS should be added. The EMS should also be attached as an annex to these documents to assist in monitoring the activities over time

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BOX 4 Criteria for Screening UNDP EOCs and EOPs Tool 3

It is recommended that the programmes projects that fall within any of the following categories be subject to further environmental consideration:

Environmentally Sensitive Areas or Activities

- Activities leading to encroachments on tropical rain forests, wetlands, mangrove forests, coral reefs, coastal zones or other vulnerable areas
- Activities changing natural vegetation and/or the habitats of wildlife species, or in areas inhabited by endangered species
- Activities in legally declared protected areas
- Ecologically fragile areas (including those identified as such by NGOs)
- Areas subject to desertification, arid and semi-arid zones, drylands
- Ecotourism activities
- Areas of unique conservation, historical, cultural, archaeological or aesthetic interest
- Areas of particular social significance (habitats for nomadic people or indigenous populations)
- Areas where pre-established pollution limits have been exceeded or where activities would lead to air, water, soil, radioactive or noise pollution

Livestock, Farming and Fishing Practices

- Sustainable agriculture
- Activities leading to soil erosion or in soil-conservation areas
- Integrated pest control or pesticide use management
- Agroforestry
- Afforestation
- Activities leading to increased grazing
- Introduction or modifications of new crops or livestock
- Introduction of new species where there is limited knowledge of the ecological functions of the local ecosystem
- Biotechnology
- Activities with the possibility of exceeding carrying capacity (e.g., catching larger quantities of fish than can be replaced by natural rate of growth)
- Controlled breeding and exploitation of fish or shellfish carried out in marine or inland waters or in artificial ponds

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Activities Dealing with Water Resources

Water management
Irrigation and flood control
Hydroelectric
Ground water
Management of inland wetland ecosystems
Health and sanitation

Infrastructure and Industrial Strengthening

Large infrastructure and urbanization activities (e.g. port development, airports and railway systems)
Energy generation
Mining (land and water)
Activities leading to conflicts over use of resources (e.g. port development and tourism)
All industrial development
Activities causing emissions to soil, water and air and or that may endanger the environment
Activities demanding considerable increases in consumption of raw materials (water, land, fossil fuels)
Activities creating major changes in landscape
Activities creating risks of accidents that could have serious consequences for local people or the natural environment
Occupational safety and training
Activities that introduce immigrant labour and change local social fabric

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Urbanization, Land Development and Waste Management

Human settlements (housing, office, commercial buildings)
Land-use planning or road building
Activities leading to accumulation of waste and creation of unwanted disposal sites
Production, transport or storage of hazardous wastes

Guidelines for Environmental Appraisal

Excerpted from UNIDO. *Project Design Reference File Volume II: Guidelines for Environmental Appraisal*. 1990.

Introduction

The environmental appraisal guidelines presented in this series have been prepared for the Project Appraisal Section of UNIDO. They are technical guidelines covering different industrial sectors, and they have the following objectives:

- To provide guidance to project planners in the introduction of environmental considerations in the design and development of projects under the auspices of UNIDO.
- To help the appraisal staff judge whether appropriate environmental measures have been included in the project in order to recommend, on environmental grounds, whether or not the project should proceed as designed.

The guidelines are for use within an environmental appraisal (EA) procedure. In a typical EA procedure, environmental appraisal comes after the screening of projects during project identification.

The screening process categorises projects according to the likely significance of their environmental impacts in order to determine the type of environmental appraisal required. Projects and programmes are screened into the following categories:

- Technical assistance projects with no capital implications. The environmental appraisal of this type of project will concentrate on environmental awareness, training and information management and on the development of technical and institutional capabilities.
- Technical assistance projects with capital implications. The environmental appraisal of this type of project will conentrate on measures for environmental management and pollution control.

Box 1 shows the list of industrial areas and their corresponding screening categories. The categorisation is indicative; the assessor will decide, according to the objectives and expected outputs, which is the appropriate category for each project.

When required by local legislation, Type B projects will be subject to an Environmental Impact Assessment (EIA). Large Type B projects sited in particularly sensitive areas will also be subject to a full EIA.

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Box 1. Categorisation of UNIDO Programmes and Projects

	Industrial Areas	Screening Categories
HRD	Human Resource Development	A
WOM	Integration of Women in Industry	A
SEC	Sector and Sub-sector Development Planning	A
ECDC	Economic Cooperation between Developing Countries	A
STRAT	Global Industrial Strategies and Policies	A
INFR	Institutional Infrastructure	A
MGMT	Industrial Management	A
PLAN	Industrial Planning and Strategies	A
FIN	Mobilisation of Financial Resources	A or B
DTT	Development and Transfer of Technologies	A or B
QC	Quality Control	A or B
ENT	Enterprise to Enterprise	A or B
PRIV	Private Sector	A or B
RUR	Rural Area/Rural Development	A or B
TCDC	Technical Cooperation between Developing Countries	A or B
ENER	Energy	B
ENV	Environmental Protection and Pollution Control	B
FEAS	Pre-feasibility and Feasibility Studies	B
REH	Industrial Rehabilitation	B

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Following screening, environmental appraisal is the mechanism by which UNIDO officers judge whether environmental considerations have been duly introduced into a given programme or project, and determine which additional environmental actions should be considered.

Although Category A projects, without capital implications, do not produce direct environmental impacts, it is important to ensure that opportunities for introducing environmental concepts and skills are duly

considered. Figure 1 presents a flowchart for the Guidelines for Environmental Appraisal for Category A projects.

For Category B projects, the guidelines take the reader through the industrial process, highlighting the points where environmental impacts are likely to occur, the receptors that may be affected and the measures to minimise the impact at each stage. The guidelines were designed in order to allow UNIDO officers to verify, at a glance, whether or not a project is environmentally sound and what can be done to improve it. Figure 2 presents a flowchart for the Guidelines for Environmental Appraisal for Category B projects.

Since environmental impacts of most industrial sectors are readily identifiable and there is sufficient information available regarding clean practices and waste treatment and disposal, we expect that most projects will be dealt with at the project formulation stage, and only exceptionally will a full EIA be required.

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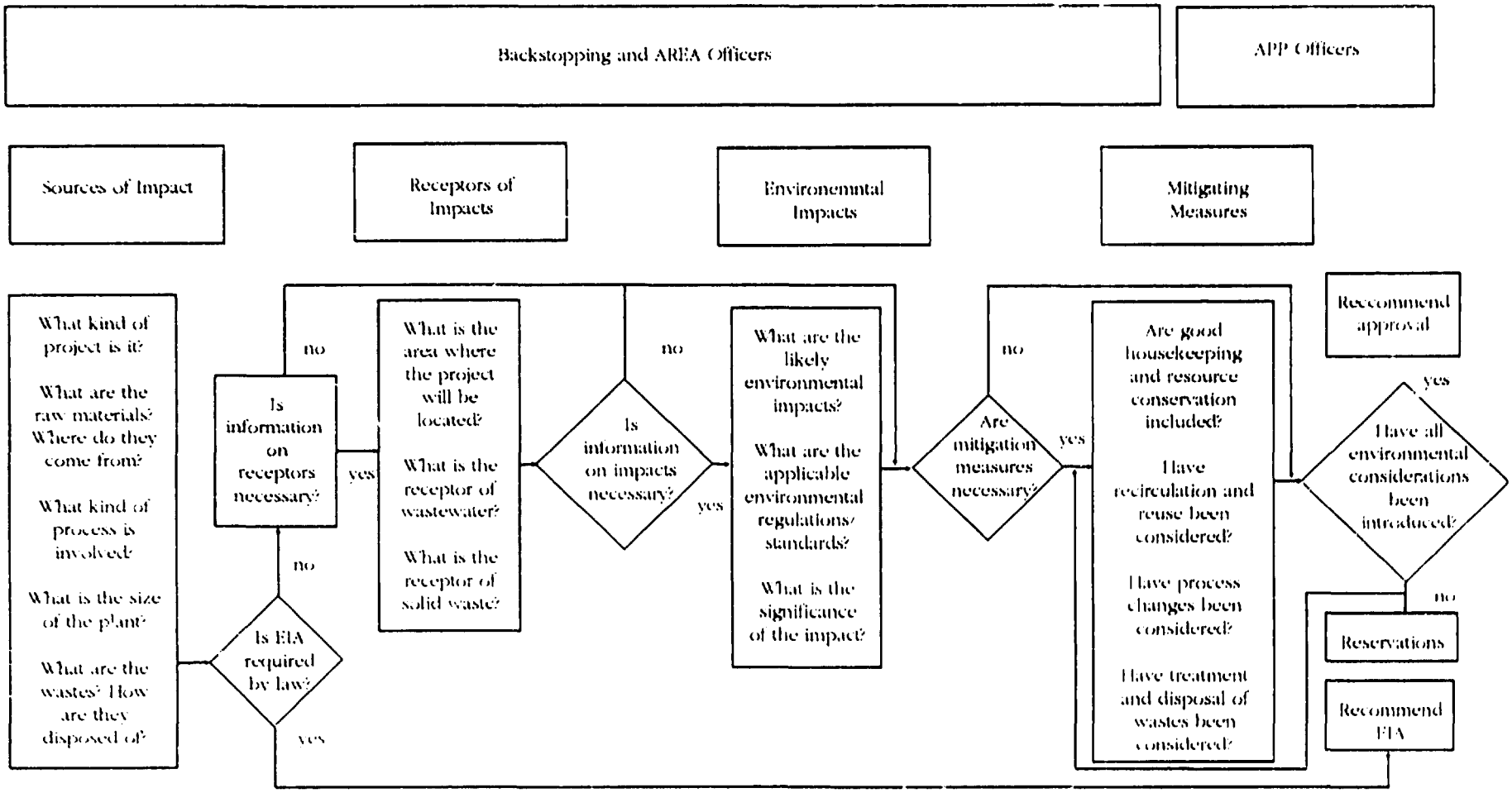
Figure 1 Environmental Appraisal Category A Projects

Figure 2. Environmental Appraisal of Category B Projects



Pollution Prevention and Abatement Guidelines for Cane Sugar Processing and Refining

Excerpted from a draft document on pollution prevention and abatement guidelines for cane sugar processing and refining, prepared by UNIDO. It will become one of a series of industrial pollution prevention and abatement guidelines being issued jointly by the World Bank, UNIDO and UNEP IE PAC.

Executive Summary

In 1991 the world sugar production amounted to approximately 114 million tons, of which 64% came from sugarcane and 36% from sugarbeet. There are more than 2200 sugar processing plants in 111 countries.

The report describes raw cane sugar processing and cane sugar refining and their respective impact on the environment. Generally, it is the effluent from the processing which is of major concern, although discharges to air, water and land occur in both operations. The residuals are generally putrescible organic materials.

Little more than 10% of the sugarcane can be processed into commercial sugar. Furthermore, for every ton of cane processed about twenty tons of water are needed. Thus, recycling and reuse of process water and residuals are very important both for the protection of the environment and for the overall profitability of operations. A well controlled and balanced production process with good sanitation which fully utilizes the possibilities for reusing residuals in the process or as by-products should be the starting point for environmental protection. In addition, treatment of water and air discharges is often necessary.

The United States New Source Performance Standards can serve as guidelines on achievable discharge limitations in the absence of national regulations. It is however important to consider factors such as: scale, age and location of plant; the assimilative capacity of the recipient medium during the crop season; and the time needed for plant upgrading (as preventive measures for pollution control are preferred it has to be recognized that these, in general, take more time to implement than end-of-pipe measures).

A considerable development of sucrochemistry and ethanol applications is expected in the near future. This development is expected to

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bring forth problems of pollution by aggressive molasses and vinasses on a much wider scale than previously associated with the sugar industry.

Waste Characterization and Impacts

The wastes associated with cane sugar processing and refining include water and air pollution and the disposal of solid wastes. The huge amount of biodegradable organic wastes from the processing is a major concern. The pollution load is therefore generally expressed in terms of biochemical oxygen demand (BOD5) or chemical oxygen demand (COD) and suspended solids. The hydrogen ion concentration (pH) and the temperature are also important parameters in determining the polluting effects of wastes in sugar factories and refineries.

Waste Quantities and Qualities

Atmospheric Emissions

The atmospheric pollution in the sugar processing and refining industry results mainly from the combustion of bagasse, fuel oil or coal. Examples of other processes giving small air emissions are: gases from juice fermentation; uncondensable gases from the evaporation stage; and sulphurous vapours released from the sulphitation process.

Bagasse combustion results in emissions of flue gas and fly ash. The composition of the flue gas depends on the composition of bagasse, its moisture and on the quantity of air used in combustion. A typical flue gas composition resulting from burning of bagasse is shown in table 1.

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Assuming an average steam consumption of 550 kg/tonnes of cane (tc) and 1 kg bagasse producing 2.25 kg of steam, the production of CO_2 would be 218 kg tc.

Table 1. Bagasse Combustion Composition of Flue Gas

Gas	Weight	Percent (%)
N_2	3.455	63.1
O_2	0.346	6.3
H_2O	0.784	14.3
CO_2	0.894	16.3
Total	5.479	100

Source: Hugot, *La Sucrerie de Cannes* 3rd Ed. Tech. & Doc. Paris (1987)

Table 2. Effluent Characteristics of Various Cane Sugar Processing and Refining Waste Streams in Different Countries

Parameter	Puerto Rico	Hawaii	Philippines	Louisiana	India
pH	5.3-8.5	—	5.3-7.9	—	6.8-8.4
BOD_5 (mg/l)	112-225	115-699	130-122[illegible]	81-562	667-1660
COD (mg/l)	385-978	942-2340	50-1880	720-1430	890-2236
SS (mg/l)	[illegible]	915-35[illegible]	240-5[illegible]	150-812[illegible]	504-936
TSS (mg/l)	[illegible]	[illegible]	—	409	792-2043
Temperature (C°)	31-4[illegible]	—	34-48	—	—

Source: UNEP. *Environmental Aspects of the Sugar Industry—An Overview*. Paris (1982).

The forced draught in modern boilers implies a large proportion of fly ash in the smoke. Boiler manufacturers estimate amounts to 5.5 kg of fly ash/tc or 4.5 g/m^3 of fly ash in the smoke during bagasse combustion.

Refineries as well as some sugar processing plants (where the bagasse is used for other purposes) burn fuel oil or coal. This results in sulphur dioxide emissions (besides fly ash emissions) which can be high when using low-grade coal or oil with high sulphur content.

Waste Waters

The sugar industry is generally considered a large water consumer and polluter. However, the situation varies from country to country and inside countries as shown in table 2. LU9

Table 3. Example of Sugar Processing Plant Waste Waters Using Approximately 1.3 m^3 Water/tc

Source	BOD_5 (mg/l)	COD (mg/l)
Cane washing	500-1500	450-8000
Condensate water	35-45	80-150
Barometric condensers	50-200	100-400
Filter mud slurry	2900-10000	6000-20000
Cleaning factory etc	3000-5000	6000-10000

Source: Meade and Chen, Cane Sugar Handbook, 10th Ed., John Wiley & sons, New York (1977)

Raw cane sugar processing

Water is essential in sugar processing, not only as a sugar solvent but also for many other uses in the process. It is used, for example, in: cane washing; extraction; liming; filter washing; crystallization; barometric condensers; cooling of engines and processing equipment; and for general purposes.

In modern sugar factories, water from vacuum condensers is recycled and a large part of condensed water from heat exchangers is recuperated for boiler feeding and other process uses. Older factories do not recycle the vacuum condenser waters and this creates a very large water through put.

If Q is the quantity of cane processed, then the immediate need of water in a sugar processing plant would be approximately 20Q. This could be reduced to 0.9Q if all possibilities for recycling are employed, and to 1.3Q with partial recycling. Table 3 illustrates BOD_5 and COD values of the main waste water sources in a sugar factory, using partial recycling of process water.

Cane washing

In some cane-growing regions the cane, though still cut by hand, is loaded mechanically for transportation to the sugar factory. In this case field mud, trash and sometimes stones are brought along with the cane to the factory. All of this creates problems in milling, clarification, juice filtration and bagasse combustion. To resolve these difficulties, washing of the cane has been introduced in some countries. There are many variations and some installations are quite elaborate. Water coming from condensers is generally used for this purpose. The amount of mud removed by cane washing varies between 5 kg to 15 kg/tc. A disadvantage of cane washing is additional loss of sugar. When washed, the amount of sugar loss can reach 0.16% of the total weight of the sugar cane.

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Water from barometric condensers

The vapours from the final evaporation stage and vacuum pans are condensed in barometric condensers. This condensation requires large amounts of water (18 tons of water/tc, with central barometric station), which gets mildly polluted, see table 2. This waste water is characterized by high temperature (45[C), low oxygen content and the presence of sugar and gases (CO_2, NH_3) in solution. In the past, the waste water from the condensers was normally directly discharged. Today it is generally re- cycled to the condensers after passing through an atmospheric cooler.

The water from barometric condensers of vacuum mud filters has a considerable sugar content, but, as it cannot be recycled, must be discharged.

Condensate water

The first stages of evaporation also generate condensate water. Some of this (all from the first and some from the second effect) is used as feeding water for the boilers. Condensate from heaters cannot be used for this purpose because it may contain juice in case of a tube failure in the heater.

The remainder of the condensates has various uses in the process (milling, liming, cake filter washing, crystallization, melting, clearing, vacuum pan washing, heating of the massecuite etc.). The excess is generally discharged. It is characterized by high temperature (> 50°C), low oxygen content and the presence of sugar and gases (CO_2, NH_3) in solution.

Cooling water for engines

Cooling of turbo-machines requires very clean and demineralized water which can also be used for cooling pumps, compressors and crystallizers. The cooling water for the mill roller bearings becomes charged with oil and is generally discharged.

Water for general purposes

The water used for cleaning of the factory becomes highly polluted. There are three main sources of contamination:

- Fermentation of juice: this occurs mainly in the preparation, extraction and clarification stages of the process.
- Mechanical sugar losses: overflows, leaking pumps etc.
- Cleaning of calorific exchangers: chemical cleaning with corrosive products such as sulphuric acid and soda implies a discharge of polluted and corrosive water after washing.

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Cane sugar refining

Waste water discharges may originate from condensers, filter back-wash, truck and equipment washing, floor drains, boiler feed blow-down.

Table 4. Example of Refinery Waste Waters

Source	BOD_5 (mg O_2/l)	COD (mg O_2/l)
Condenser waters	4-21	6-42
Filter mud slurry	750	1200-1400
Charcoal waste	750-1200	1200-2400
Truck wash water	15000-18000	22000-36000

Source: Meade and Chen, Cane Sugar Handbook, 10th Ed., John Wiley & sons, New York (1977)

engine cooling, floor washing and other miscellaneous processes. The pollutants are primarily:

- Insoluble suspended solids: mostly water slurries of calcium carbonate or phosphate salts, diatomaceous earth, spent charcoal etc.
- Dissolved waste consisting primarily of biodegradable carbohydrates.

The average BOD_5 content in refinery waste water is about 1000 to 2000 mg/liter. Volumes of effluent range typically between 18 to 25 m^3 water per ton of sugar.

Fugitive Emissions

Small, fugitive emissions result from juice fermentation; uncondensable gases from the evaporation stage; and sulphurous vapours released from the sulphitation process.

Upset and Emergency Conditions

The storage of raw bagasse is a problem due to the large volumes involved and its low time of preservation. A considerable storage area is required and the rapid degradation causes a risk for internal combustion after a few months of storage only.

Impact on Receptors

Most waste waters from sugar processing and refining are not toxic yet harmful to the environment at higher levels of biological oxygen demand. This is due to the carbohydrate content and the products of their degradation. Organic substances discharged into water (rivers, lakes) are decomposed by microorganisms which use large quantities of oxygen. The resulting lack of dissolved oxygen affects the breeding of fish and the ecological equilibrium of the receiving medium. Waste water from sugar processing also contain oil, solids, caustic and acid. All of these products cause severe non-biological contamination of receiving waters.

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On land, the use of residual water or by-products for irrigation must be strictly controlled and used according to the requirements of the crop and the soil, and not as a means of waste disposal. The high Chemical Oxygen Demand/Nitrogen content (COD/N) ratio does not allow an intensive application during the first stages of cane development.

Pollution Prevention and Control

Management Implications

A considerable development of sucrochemistry and ethanol applications is expected in the near future. This development will bring forth problems on a scale, especially associated with pollution by ag-

gressive molasses and vinasses, that make current problems appear insignificant. To counteract, suitable national strategies for environmental protection in the sugar sector must be developed.

Such strategies must consider the current situation of the sugar sector, its achievements and difficulties and its future development. If a national Master Plan for the restructuring, strengthening and development of the sugar sector exists, it is a good base on which to formulate a comprehensive environmental protection strategy. Issues to consider include:

- How to establish a step-wise approach that is suitable for the current situation as well as future developments. Environmental protection is as much a problem of attitudes as of investment capital. Acquisition of knowledge and training takes time. It took developed countries more than 20 years to modify attitudes concerning pollution problems so as to obtain a wide consensus that action was needed.
- What legal dispositions and control means must be set up? What encouraging measures and aids are needed? What penalties should be imposed in case of regulations being violated?
- How to ensure full and close cooperation between government authorities, sugar institutions and sugar producers, and how to provide them with adequate training and necessary laboratory equipment and facilities.

Immediate improvements of the environmental performance are possible at the plant level. Sugar producers must be made aware that a well-controlled and balanced factory with good sanitation is the most effective way to prevent pollution. Furthermore, the possibilities for reusing wastes in the process or as by-products are rarely fully exploited. Once this awareness is established two actions which assist them in achieving a higher level of environmental performance are:

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- a corporate environmental policy that gives clear goals, responsibilities, actions and targets
- establishment of a proper environmental management structure to ensure implementation of the policy, to allocate resources, and to monitor (and report) the results.

Source Reduction

Cane sugar processing and refining offer many waste minimization opportunities through reduction of wastes at the source, or, reuse in the process or as by-products.

Atmospheric emissions due to uncondensable gases can be decreased by using good sanitation and careful control of the whole

operation. Flue gas emissions can be reduced by controlling combustion, air pressure and the rate of excess air.

The sulphitation clarification process is used in many sugar factories for the production of 'white plantation sugar'. This process, associated with a high pollution load, has been replaced increasingly by other methods, such as: Talo-floc process; uses of bentonite; double centrifugation; affination etc.

It is important that the cane is processed as soon it arrives at the plant to avoid deterioration with resulting sugar losses and odour problems. Immediate processing will also reduce the storage area needed. Dry cleaning systems which reduce or replace cane washing will result in reduced amounts of sludge.

If the production of slurries is unavoidable, in several cases contamination can be greatly reduced by means of such precautions as:

- Elimination of refuse, pieces of cane stalk and suspended dirt from the used wash water by screening before lagooning. This precaution allows decreasing the BOD load.
- Maintaining absolute cleanliness at all stations.
- Avoiding fermentation of sugar-cane juices by: appropriate straining; proper sanitation of the mills; controlled application of disinfectants or biocides in mill juices; and systematic cleaning when the milling has stopped.
- Investigation of abnormal sugar losses in order to find and rectify the cause.
- Calculation of the general water balance of the factory for each crop.
- Maintaining a systematic control not only of boiler feeding water but also of the waste water.
- Periodic inspection and BOD control of lagoons.

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A significant source of waste water loading is due to poor housekeeping practices, involving spills of sugar and molasses, and poor maintenance of machinery and equipment, which also contribute to oil and grease contamination of effluent. The cost of effective in-plant control is negligible when compared to the costs of effluent treatment and production losses.

Recycling and/or By-Product Recovery

Little more than 10% of the sugarcane can be processed into commercial sugar. Furthermore, for every ton of cane processed about twenty tons of water is needed. Thus, recycling and reuse of process water

and residuals are very important both for the protection of the environment and for the overall profitability of operations.

Waste Segregation

Establishing good water management with as much recycling of process water as possible is essential. The segregation of waste streams with a low BOD load from streams with a high BOD load is vital in this context. Few sugar factories and refineries segregate waste streams in a systematic way. Examples of the potential of this approach are:

- Excess condensate water does not need any treatment because of its low pollution load and can be separated from other streams, see tables 2 and 3.
- In sugar factories where cane washing is practiced, the spent water is generally treated by impounding and recycled to the initial wash. This circuit has to be separated from other treatment circuits because the retention time is different. Fresh water is only used for the final wash.
- Cooling water for mill bearings contains mineral oils and should not be mixed with other waste streams destined for biological treatment without a previous passage through an oil separator (which is a very simple factory-made device). With an efficient oil separation, this water can be recycled.
- In both sugar factories and refineries, acid and caustic waste arise from the cleaning of heat exchangers, evaporators, pans and other equipment. These wastes must be kept separated from other wastes, stored and released gradually into furrows, and blended with general effluent.
- In refineries, the main water pollution load comes from washing trucks and floors. Two waste water circuits are sufficient, one for excess condensate water which needs no treatment and another for treating the wash water.
- Vacuum condenser streams are too large for economical treatment. Entrainment channels should be installed to prevent any contamination of this waste stream.
- Concentrated low volume streams can be biologically treated in lagoons or aerobically in an activated sludge plant.

By-Products

In almost all sugar factories and refineries, by-products are recovered for industrial use, for animal feeding and for fertilizing

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Boiler ash and fly ash

Boiler ash and fly ash can be used in glass manufacturing, as a basic fertilizer in agriculture and incorporated in slag cement and road bases. The average quantity produced is about 0.3% of the weight of cane.

Another possibility is to use recovered fly ash in place of bagacillo in vacuum filters. The density and composition of fly ash and the dimension of particles would produce an excellent filter cake. The need of bagacillo for filters is about 5 kg/tc at 49% moisture, equivalent to 4 kg/tc of fly ash which is more dry. Available quantities of fly ash, 5.1 kg/tc, adequately fulfill these requirements. The arrangement is very simple and inexpensive and consists of a mixing tanker and a slush pump. This is particularly interesting for those cane sugar plants which are short of bagacillo.

Bagasse

1000 kg of cane produces some 250-300 kg of bagasse, consisting on average of 49% water, 48.5% fiber and 2.5% of dry matters (sucrose and non-sucrose). Most of it is used to generate the steam and energy required by the factory. Surplus bagasse, due to its low density (160 kg/m^3) and relative inflammability, is a cumbersome material to handle and transport. It is generally used to produce paper, board and electricity.

Filter mud

About 30-35 kg of filter mud are produced per ton of cane. Filter mud consists of 80% water and 0.9 to 1.5% sugar. It can be spread directly on agricultural fields or stored in an intermediary silo for later use as a soil conditioner. When used for this purpose care must be taken to avoid runoff to watercourses; filter mud has a large BOD load

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Molasses

Between 27 kg to 40 kg (average 30 kg) of molasses are produced per ton of cane. Its average composition is 20% water, 35% sucrose, 20% reducing sugar, 15% sulphated ash and 10% others. Molasses is mainly used as animal feed or transformed into rum, alcohol or ethanol by fermentation and distillation.

In the distillery, 1000 kg of molasses give 400 l of pure alcohol (240 kg) and 3800 l of stillage (also called slop or vinasses). Direct distillation of 1000 kg of cane juice yields approximately 70 l of pure alcohol and 910 l of vinasses. Vinasses are often sent to the cane field as fertilizer, either pumped to neighbouring fields or carried to more remote fields in motor tankers. This practice constitutes a major risk for the environment and especially contamination of ground waters if not adequately controlled by agronomists.

The use of diluted molasses and vinasses as fertilizers is much more complicated than, for example, the use of ashes and filter mud for such purposes. Successful fertilization with molasses and vinasses must

consider the demand of the cane plant which differs with variety, age, soil, climatic condition and season. Furthermore, the retention time needed for the release of the fertilizing elements from the by-product has to be considered in relation to the permeability of the soil.

Irrigation with residuals

The residual water from cane sugar operations has a high content of organic matter and nutrients and is thus considered a valuable biofertilizer. In countries where water is scarce cane sugar effluent can be used for irrigation. With strict control and norms of application it can be considered the most practicable technology. In Cuba, irrigation with residual water has been systematically used with the following modes of application (See ICIDCA/GEPLACEA/UNEP, *Handbook of Sugar Cane Derivatives*, UNEP, Mexico):

- Outflows with high dissolved salt content, particularly sodium, and acidic effluent must be separated from the water used for irrigation. Examples of such effluents are exhausted soda, overflow from the coolers when soda has been used to raise the pH and acidic cleaning water.
- After preliminary treatment to remove oil and suspended matters and correction of pH, the residues are cooled and homogenized before being applied to the soil. A storage system with two reservoirs designed for the total volume of residual water from the sugar factory is used. In the first reservoir the water remains for one or two days, giving time for homogenization and cooling but without allowing degradation of the organic matter. The second reservoir is only for preventing the water from spilling into a watercourse, when steady irrigation is not possible.

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Table 5. Cost and Benefits of an Effluent Irrigation System of a 6,800 tc/day Sugar Factory in Cuba

Technology	Investment (1991 US$)	Maintenance and operating cost (US$/1000m3 effluent)	Savings (US$/1000m3 effluent)
Irrigation system	297,000	59.24	40.76

The plant in question produces about 0.55 m^3 effluent for every ton of milled cane or 560,000 m^3 per crop season. The pay-back period for the investment is thus approximately 13 crop seasons. 188 hectares are irrigated.

Source: ICIDCA/GEPLACEA/UNEP, *Handbook of Sugar Cane Derivatives*, UNEP, Mexico

- One year of effluent irrigation must be followed by one year of normal irrigation for light soils (two year periods for heavy soils), and in both cases using standards that do not exceed 300 to 400 m^3/hectare at intervals of 10 to 15 days.
- The salt level in the soil subject to irrigation with cane sugar effluent must be checked periodically.
- Where necessary grease and oil traps are installed and cleaned periodically.
- Due to the high carbon nitrogen (C:N) ratio in this type of water, irrigation must not be applied intensively during the first stages of crop development, when plants require more nitrogen. It might be necessary to add a nitrogen fertilizer.

Actual investment, operating and maintenance costs, and savings for a cane sugar effluent irrigation system, compiled in table 5, are based upon experiences from Cuba.

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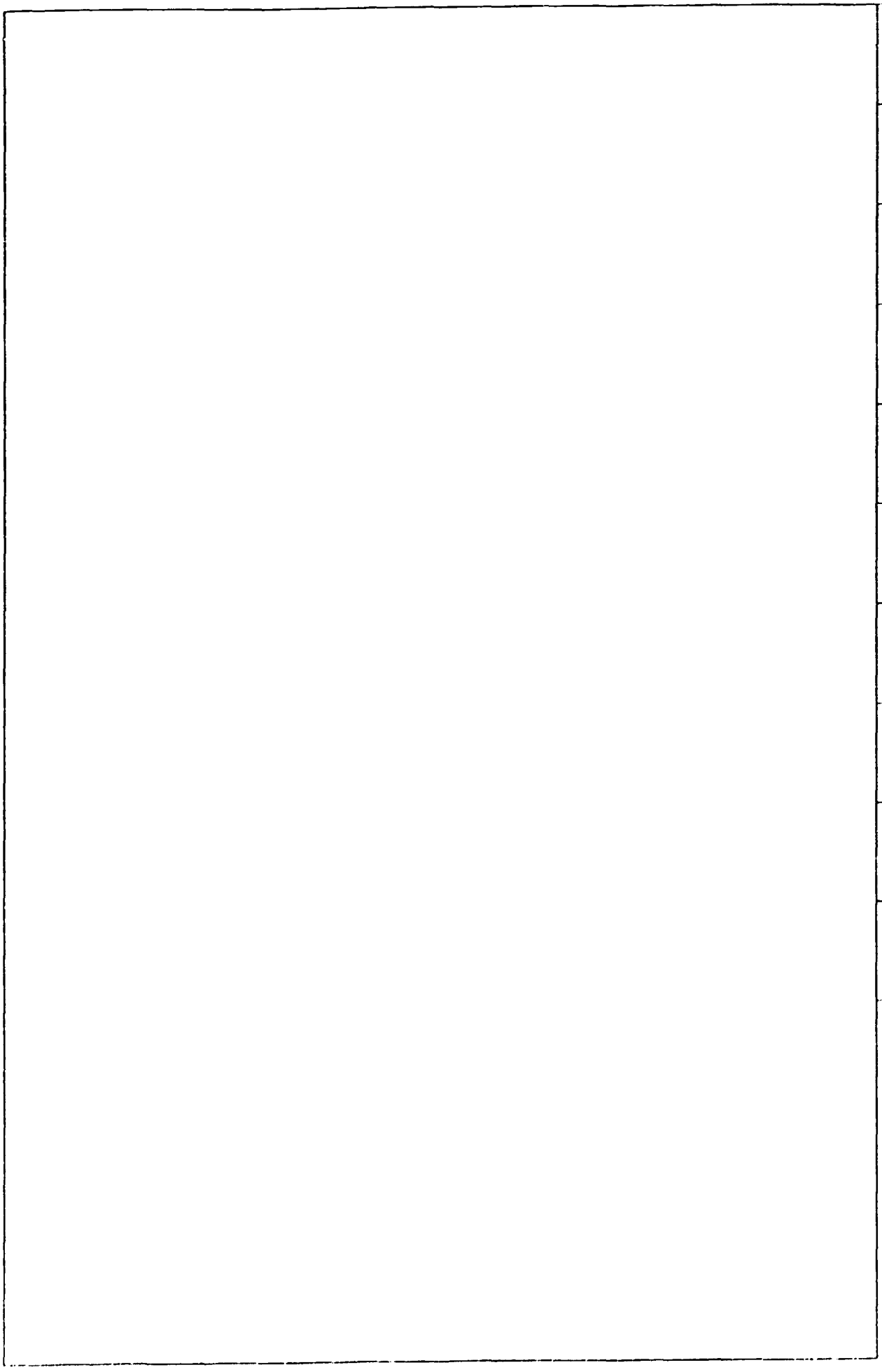
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Environmental Overview of Project Management Strategy for a Sample UNDP Project

Excerpted and modified, with permission, from UNDP, *Handbook and Guidelines for Environmental Management and Sustainable Development* (New York, 1992), annex III and annex IV.

Cenderawasih Bay Coastal Area Development (INS/88/011/D/01/12)

The three main objectives of this project are to establish a cost-effective system of local transportation and communication to improve the collection and marketability of produce from the area; to introduce new methods and techniques to increase the use of fisheries and estate crop resources, ensuring the increased participation of women, and to strengthen the institutional capacity of the national, provincial and local planning bodies and various line agencies.

1. Brief Description of the Natural Environment of the Area of the Project

The land area of Irian Jaya province, including the fringe islands, is 410,000 square kilometres. In general the climate can be divided into two seasons: a dry one December to April, and a wet season from May through November. However, the dry season is relatively wet, with as much as 7,500 millimetres of rain a year. In the coastal towns the mean temperature is 26 degrees Celsius, with a minimum of about 20 degrees Celsius. In the mid-mountain valleys, the temperature ranges from about 11 to 27 degrees Celsius.

Irian Jaya has a population of 1.5 million inhabitants, more than half of them in the lowland (coastal) areas and on off-shore islands. These people have had varying degrees of contact with modern civilization. The nine principal towns are Jayapura, Biak, Sorong, Manokwari, Fakfak, Nabire, Wamena, Merauke and Serui.

Jayapura, located on Jos Sudarso (Humbolt) Bay had a population of some 111,030 in 1987; it is the administrative centre of the province as well as the principal port. Biak is an island north of Cenderawasih Bay with an estimated population of 41,850.

This is a decentralized area development project that integrates development assistance initiatives for the Biak, Yapen and Waropen areas. The population affected as recorded in the 1985 census was 136,900, approximately 10% of the population of Irian Jaya.

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The marine resources of the area are substantial, but at present they are used to supply only the small markets. Of predominant importance are the pelagic fish, the main species being skipjack, tuna and mackerel. Prawns of high quality exist in some coastal areas.

2. Main Environmental Issues in the Project Area

The residents of the project area are almost entirely indigenous Irianese of several distinct ethnic groups whose livelihood is based on hunting and gathering, shifting cultivation and to a limited extent coastal fishing.

Most of the people in the Cenderawasih area rely to some extent on sea fisheries and/or some smallholdings of perennial tree crops. Small-scale fisheries and estate crops can be used as a source of food, employment and non-oil export earnings. These small operations have the advantages of being labour-intensive, having a high return on the capital invested and being central to the operation of the project.

The fish species in the Cenderawasih Bay are migratory and use the Bay for a temporary feeding ground before continuing on to other areas. This nutrient-rich feeding ground is a fragile ecosystem created by a unique island and underwater geological formation and its resulting influence on ocean currents of the region. The intensive exploitation of this ecosystem and its resources must be carried out only after a thorough examination is made of the total ecological dynamics of the bay ecosystem and its resources.

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One of the objectives of the project is to introduce new methods, techniques and technologies to increase the use of the fisheries and estate crop resources. Accomplishing this goal can bring significant benefits to the local population (mainly new jobs and additional income). Fish and prawns can be caught by local fishers and can be iced (or frozen) immediately to be sold in local markets or to a multinational company based in Biak, which has agreed to purchase the project's catch. It is of paramount importance to take into consideration that intensive fish exploitation might easily have an adverse effect (especially on the tuna fish) if the carrying capacity of the pelagic migratory species is not assessed and fully respected.

The project document addresses the need to further incorporate women in commercial activities such as marketing fish and estate crops. However, women in the project area show a much higher mortality rate than men. Thus in order for them to benefit from the economic undertakings envisaged by this project, any activity that requires additional work for women must be carried out only after taking into consideration their health situation and the quality of the working environment for women.

Another objective of the project is to introduce a coastal transportation system to export estate crops. Again, by linking the project area to the

external economy it is expected that the exploitation of cocoa will increase considerably. The sustainable exploitation of this and other local crop produce must be determined to maximize profits and avoid the degradation of local land ecosystems.

3. Economics and the Environment in the Project Area

Approximately 55% of Indonesia's labour force works in agriculture, forestry, hunting and fishing. The incidence of poverty (44.6%) and underemployment is twice as high in rural areas, where 80% of Indonesians live as in the cities.

Indonesia's production of fish, both for domestic consumption and for export, accounts for approximately 6.8% of real GDP. In recent years fish products, particularly shrimp, have become increasingly important exports. Indonesia has great potential in further developing tuna fish production.

All the fish production in the Cenderawasih Bay comes from very small-scale marine capture. Some 77% of the registered fishers in Irian Jaya work in the Cenderawasih Bay. With the exception of one large joint venture holding, all estate crops production comes from smallholder operations, based on the family unit.

A multinational fishing company, P.T. Multi Transpeche Indonesia, operates a number of tuna fishing boats. Although not permitted to fish in the Cenderawasih Bay area, the company has expressed its desire and provided both verbal and written assurances to purchase all tuna species caught by those in the project. Prices would be agreed on prior to sale and could be revised to reflect the changing nature of the international market. The economic benefits that the multinational company would bring to the project area will be optimal only if the demand for tuna fish does not exceed the carrying capacity of this migratory species. The project should discuss how the carrying capacity would be determined and respected.

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The development of estate crops in the area is directed to only cocoa and coffee. Cocoa is by far the most important. The Estate Crop Department would undertake the activities as outlined in the project document. The Irian Jaya Joint Development Foundation has a series of marketing outlets in the area and has disbursed credit to many local estate crop farmers.

Indonesia has a long tradition of significantly subsidizing the use of chemical pesticides. The project should discuss how the promotion of estate crops will be carried out while protecting the environment.

Women in the traditional Irianese fishing country are involved in the marketing of the catch. In the case of estate crops, women play a much broader role, being responsible for harvesting as well as processing and

marketing the produce. The development and extension of post-harvest technology and activities will be aimed particularly at women and women's groups to provide the basis for additional income-generating activities. The benefits of these activities, however, will only be realized if the working conditions of women are appropriate from an environmental viewpoint. The project does not discuss this.

4. Environmental Management in the Project Area

The main environmental actors in the project area include: the fishers (smallholders and co-operatives); the central government; various government departments (Ministry of Environment and Population, the Assistant to the Minister-Chairman BAPENNAS for Women's Affairs, Directorate General of States, Directorate General of Fisheries, Directorate General of Co-operative Development and Department of Finance); local government, and outside governments (the Government of the Netherlands).

Within the private sector, the main actors are a multinational fishing company (P.T. Multi Transpeche Indonesia), local industries and agricultural co-operatives. The various non-governmental organizations involved include Irian Jaya Joint Development Foundation, Yayasan Pendidikan dan Pengembangan Masyarakat di Irian Jaya-Foundation for Education and Community Development in Irian Jaya (YPPM), the World Wide Fund for Nature and church groups. International organizations such as UNDP, UNFPA, UNESCO, FAO, the Asian Development Bank and World Vision International are also involved.

The introduction of new technologies to exploit marine resources will intensify their exploitation. This might result in depletion of pelagic species unless an appropriate environmental management scheme is adopted.

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Some of the objectives of the actors conflict with each other. For example, smallholder fishers prefer to work individually rather than in co-operatives. By the same token, the interests of the multinational fishing company conflict with the objectives of resource protection as expressed by the World Wide Fund for Nature. The project must envisage ways to avoid or at least lessen these conflicts.

The main institution responsible for the environment in Indonesia is the Ministry of Environment and Population (KLH). This ministry is represented locally by the PKLH, including in the project area.

The Ministry of Agriculture has two divisions that are relevant to the work of the project area: the fishery division and the Agency for Agricultural Research and Development (ARD). The Vice-Governor's Office has a division specifically assigned to review women's issues.

There is a local Environmental Studies Centre in Biak as well as a Population Studies Centre. Both institutions carry out relevant environmental research in the project area.

Most of these institutions located and/or operating in the project area need to strengthen their technical and managerial capabilities in order to develop policies and practical actions to protect and enhance the local environment.

5. Major Environmental Impacts Associated with the Implementation of the Project

The project promotes the development of a monoculture economy. This might impose serious limitations in the ability of land ecosystems to retain nutrients. The diversification of agricultural produce should be considered.

The promotion of labour-intensive activities in low-populated areas such as Biak will promote migration. More people living in poor environments usually results in environmental degradation. The additional population would have to be furnished with appropriate living conditions in order to avoid further degradation of existing resources.

The project envisages training for some local fisheries and the promotion of co-operative schemes. While both objectives are expected to improve the economic situation of some sectors of the local population, those who will not benefit from the project (other fishers and women) might be displaced from local markets.

6. Alternatives to Proposed Project Design

The project of the Cenderawasih Bay Coastal Area Development could be improved, from an environmental point of view, by carrying out the following actions:

- Define with more precision the links between fishery and agriculture activities.
- Examine underlying government policies that might affect the management of resources in the project area.
- Integrate the local government administration (particularly the BKLH) in project implementation.
- Identify more precisely the potential environmental benefits that could be derived from implementing the project.

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7. Identification of Environmental Objectives of the Proposed Activity

The marine resources of the area are substantial, but at present they are used to supply only the small markets. Of predominant importance are the pelagic fish, the main species being skipjack, tuna and mackerel. Prawns of high quality exist in some coastal areas.

The main environmental objectives of the Cenderawasih Bay Coastal project include:

- Promoting a sustainable exploitation of marine resources in the Cenderawasih Bay Coastal area,
- Promoting a proper demographic distribution of the population who will be attracted by the implementation of the project,
- Developing agricultural production schemes for cocoa and coffee using techniques compatible with the functioning of the local environment,
- Improving the environmental working conditions of women participating in the project,
- Strengthening local institutions responsible for the use of natural resources in the project area, and
- Redesigning the local policies relevant to the exploitation of natural resources in the project area.

8. Identification of Possible Conflicts of Interest

The Cenderawasih project must identify in advance all possible conflicts of interest that might occur if the project is implemented and provide a forum and organize relevant negotiation activities for these groups in order to mitigate or resolve such conflicts.

Several actors have objectives and strategies that might conflict with each other. For example, the interests and strategy of Transpeche, the multinational fishing company in the area, will conflict with smallholder fishers and with some environment non-governmental organizations (NGOs).

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Similarly, the local Ministry of Environment and Population (BKLH) might conflict with the cocoa and coffee cooperatives if the latter use chemical fertilizers and pesticides to increase the productivity of agriculture.

Additional possible bottlenecks include:

- Resistance of government officials and UNDP staff to development and implementation of the EMS,
- Lack of economic resources for implementation,
- Potential resistance of the executing agency to adoption and implementation,
- Refusal of government authorities to use some of the funds assigned to this project for the implementation,

- Lack of support of UNDP HQ staff for implementation and lack of cooperation of one or more of the participants in environmental management for the project area.

One possible way to overcome the last bottleneck would be through environmental negotiation with neutral mediators who would assist conflicting interests and parties to work together to form alternatives that might incorporate the interest of all parties concerned.

9. Formulation of an Operational Strategy

The operational strategy of the project consists of identification of specific environmental targets to be achieved for the protection of the marine environment and the agricultural sector and for institutional development. The strategy also suggests ways to manage the potential conflicts between those involved in environmental management in the project area. Finally, this strategy includes a plan of activities and timetable, and the identification of information and other supporting needs necessary to implement the strategy.

Specific Environmental Targets

For the marine environment

- Determine the size and ecological dynamics of commercial pelagic species such as tuna fish and mackerel and of shrimp.
- Determine a maximum ceiling for the catch of tuna fish and shrimp during the dry season and develop appropriate mechanisms to establish a ban on fishing in breeding areas.
- Review and integrate the present laws, policies and programmes of the fishery sector with a view to promoting higher fish productivity while protecting and enhancing the marine environment.
- Analyze the potential environmental impacts of proposed new fishing technologies and select only those compatible with the environment.

For the agricultural sector

- Make an inventory of the chemical fertilizers and pesticides used in the country and authorize only those products that have not been banned or severely restricted in Indonesia and/or by other countries according to the United Nations List of Toxic Chemicals and Harmful Substances.
- Examine the possibility of promoting the development of agricultural produce other than cocoa and coffee.
- Analyze the potential environmental impact of proposed new agricultural technologies and select only those compatible with the environment.

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For institutional development

- Train local personnel (at the Centre for Population Studies and Centre for the Environment) in techniques to assess the carrying capacity of marine ecosystems; develop managerial schemes to monitor the exploitation of tuna fish and shrimp.
- Train local planners at the BKLH to integrate marine and coastal development activities in order to protect the local environment and obtain the maximum benefits of long-term sustainable exploitation of resources.
- Support the activities of the Department of Women's Affairs in the Office of the Vice-Minister of Indonesia in order to strengthen their participation in local projects such as the Cenderawasih Bay Coastal Area.

Participants in Environmental Management

The main participants in environmental management in the project area have different objectives and strategies.

Actor 1: government sector

The main government actors at the national level include the Assistant to Minister/Chairman BAPENNAS for Women's Affairs, Directorate General of States, Directorate General of Fisheries, Directorate General of Cooperative Development, Department of Finance, Directorate General of Agriculture, and Ministry of Environment and Population (KLH). The strategy of these actors is to regulate the activities of other social actors and to coordinate the economic development programmes and activities of Indonesia, keeping in mind the priorities established in the 5th National Development Plan (REPELITA V).

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The main government actors at the local level include BKLH (from the Ministry of Environment and Population), BAPENNAS (from the Ministry of Planning), and Ministry of Agriculture. The strategy of these actors is the same as the national government but this time the scope of application is local.

Actor 2: private sector

The main actors within the private sector include Multi Transpeche Indonesia, fishers and agricultural cooperatives, smallholder fishers and the local sea transport company that will benefit from the project and increase the movement of agricultural produce from Biak to other villages in the project area.

Transpeche's main objective is to maximize the exploitation of tuna fish. Their strategy is to establish joint ventures with the local cooperatives of fishers especially in view of the fact that Transpeche is banned from fishing in Cenderawasih Bay. The local cooperatives want to work with

Transpeche and oppose individual fishing schemes. In turn, smallholder fishers see themselves as independent entrepreneurs. Their strategy is to promote artisinal fishing and avoid organized schemes. They oppose the participation of Transpeche in the commercial life of the project area. Women who participate in the commercialization of fruits and other agricultural products would probably like to work with the local sea transport company in order to have a greater input into local commercial markets where cocoa and coffee are sold. Their strategy also includes supporting local agricultural cooperatives. By the same token, the agricultural cooperatives strategy is to promote organized work for the exploitation of agricultural produce.

Actor 3: non-governmental organizations

The main NGOs present in the project area include Irian Jaya Joint Development Foundation, Irian Jaya Joint Development Foundation, Yayasan Pendidikan dan Pengembangan Masyarakat di Irian Jaya-Foundation for Education and Community Development in Irian Jaya, World Wide Fund for Nature and church groups. These NGOs are mainly development and environment-oriented. Their general aim is to work at the community level and assist people in satisfying their basic needs (health, food and shelter) and attaining a higher standard of living.

The international organizations in the project area include United Nations Organizations (UNDP, UNFPA, UNESCO, FAO), the Asian Development Bank (ADB) and World Vision International. Their strategy is to support the activities and development initiatives established by the Indonesian government.

Plan of Activities and Timetable

A list of activities and a timetable necessary to explicitly include the environmental dimension in the project should be included in the EOP/MS.

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Environmental Information

The following environmental information must be sought to implement the EMS properly (this is not a comprehensive list but examples of the type of information needed for implementation):

- Inventory of environmental studies related to the project area and its resources.
- Dynamics of local marine ecosystems.
- Size and dynamics of tuna fish population.
- Patterns of human migration associated to the implementation of the project.
- Inventory of chemical fertilizers and pesticides used in the project area.

- Environmental factors that influence the present higher mortality rate in women living in the project area.

Supporting Needs

The EMS will require five main types of support in order to be implemented: education and training, technical and managerial skills, access to data banks, institutional support and financial aspects. The following are the specific supporting needs required to implement the Cendrawasih project:

Education and training

- Training course for local government authorities on environmental planning and environmental monitoring.
- Course on environmental protection of marine resources.

Technical and managerial skills

- Training UNDP local staff and BKLH on methodologies for conducting environmental audits.
- Training members of cooperatives on environmentally sound practices for fishing and for coffee and cocoa production.

Access to environmental data banks

- Identify environmental data banks relevant to the project area, such as the United Nations List of Banned and Severely Restricted Chemicals.

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Institutional support

- Identify the technical needs of the Centre for Population
- Studies and the Centre for Environmental Studies of Irian Jaya.
- Strengthen the environmental auditing and environmental monitoring capacity of the BKLH

Supporting needs

The original project proposal may need to be modified in order to incorporate the activities outlined in the EMS. While it is beyond the scope of this example to create an entire new budget, this section should contain all of the budget changes each activity should be itemized, and potential short and long term savings and costs should be noted.

Implementation Responsibilities

In order to list who is responsible for implementing each of the activities listed in the EMS, each of the potential players will have to be consulted and give their consent. After this is done, a list should be drawn

up identifying each individual by name and the task for which he she has responsibility and the time in which it will be completed In order to not specify Indonesian citizens in the example this section has not been completed.

Decision Making

The regulatory decision making in Indonesia lies with the central government Local government institutions are rather weak and lack autonomous power BAPPENAS is the government ministry with highest political authority in the country The Ministry of Finance allocates economic resources for an activity within the framework of the REPELITA V.

10. Monitoring the EMS

The responsibility for monitoring the implementation of the EMS belongs to UNDP, the executing agency and the government counter-part responsible for implementing this project Page 43 and Table 1 of the Environmental Management Guidelines can be used for suggestions regarding specific checkpoints during the life of a project when the EMS can be monitored for environmental impact

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