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POLLUTION CONTROL RESEARCH INSTITUTE, HARDWAR, INDIA

DP/IND/83/008/11-13

Republic of India

Expert Report*

Prepared for the Government of India

by the United Nations Industrial Development Organization

acting as executing agency for the United Nations Development Programme

Based on the work of Professor Per Wramner

of a Mission in Nov - Dec. 1988

Backstopping Officer: R.O. Williams, Chemical Industries Branch

United Nations Industrial Development Organization

Vienna

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1 Introduction

As a UNIDO consultant I have spent three weeks in November-December 1988 in India (exclusive of time for travel, preparation of a paper etc.) to give technical assistance to the BHEL Pollution Control Research Institute (PCRI) in the field of ecological protection and control. According to the Special Service Agreement for Expert on Mission (Post Key Code DP/IND/83/008/11-13 31342A) and the Job Description, I should:

(1) Participate in the International Conference on Environmental Impact Analysis for Developing Countries in New Delhi 28/11 to 2/12. 1988 and present a paper on environmental protection in relation to environmental impact assessment for industry.

(2) Spend two weeks at PCRI (Hardwar) for discussions with the technical and administrative staff concerning:
- focus of current PCRI programme and identification of projects of relevance to India and of potential commercial value to PCRI;
- training programme for PCRI technical staff; and
- project equipment requirements.

(3) Prepare a report in English of the findings of the mission.

At an initial discussion with Mr. S.B.C. Agarwala, Head of PCRI, and Dr. A.K. Biswas, Chief Technical Advisor to PCRI, two further tasks were added. Together with the other UNIDO experts present in Hardwar, I should analyse the future role of PCRI (from 1990 and onwards) and make proposals concerning its direction of work. I should also guide and supervise a group of seven researchers and give general lectures on ecology and environmental management. The group consisted of Dr. N.C. Trehan (Dy. Manager) Dr. N.C. Shrivastava (Jr. Executive), Dr. (Mrs) Neelam Srivastava (Jr. Executive), Miss Nargis Begum (Lab. Asstt.), Mr. Vipin Kumar (Lab. Asstt.), Mr. A.K.P.N. Singh (Lab. Asstt.), and Miss Krashna Tidkey (Lab. Asstt.).

The itinerary of the mission can be summarized as follows:

27/11 Travel Stockholm - New Delhi

28/11 Briefing at UNDP New Delhi, participation in the EIA Conference

29/11 Participation in the EIA Conference

30/11 Participation in the EIA Conference

1/12 Participation in the EIA Conference

2/12 Participation in the EIA Conference

3/12 Travel New Delhi - Hardwar. Initial discussions with the Management of PCRI

5/12 Preparatory meetings with the Management of PCRI, the UNIDO experts and my group of PCRI researchers

6/12 Discussions with PCRI's researchers and technicians in the field of ecological protection and control, examination of PCRI's laboratories and library

7/12 Lectures on basic ecology (mainly structure and function of various ecosystems) and ecological consequences of various disturbances caused by man

8/12 Lectures on EIA-methodology, especially EIA of industrial and energy projects and the role of an EIA-consultant

9/12 Lectures on environment management planning, especially in industrial and urban areas

10/12 Seminar on ecological modelling, discussions about the need for training abroad for PCRI's staff in the field of ecological protection and control

11/12 Visit to Indian Drugs and Pharmaceuticals Ltd, Virbhodra, Rishikesh, examination of the waste water treatment plant and discussions of how to improve its efficiency

12/12 Visit to Dehra Dun (Indian Institute of Remote Sensing, Map Publication Directorate of the Survey of India and the Geological Survey of India), discussions about future cooperation with PCRI

13/12 Lectures on tropical ecology, plant ecology and the ecological basis for forestry in India

14/12 Concluding discussions with the UNIDO experts

15/12 Concluding discussions with the Management of PCRI

16/12 Travel Hardwar - New Delhi, report to UNDP

17/12 Travel New Delhi - Stockholm

2. The EIA Conference

I participated in the International Conference on Environmental Impact Analysis for Developing Countries in New Delhi 28 November - 2 December 1988. I was Chairman of Technical Session IX: Biological Impact and Co-Chairman of Technical Session VI: Waste Management and Land Use Impact. I also presented a Key Paper: EIA of Industrial Development Projects Some Problems Faced in Nordic Aid Programmes. The paper is attached as Annex 1.

The EIA Conference was successfully arranged by FCRI. About 250 participants presented about 120 papers, including quite a number of great scientific interest. However, the great number of papers - a considerable part of which did not deal with EIA - meant that the time available for discussions was insufficient in some sessions, including the sessions chaired and co-chaired by me.

3. PCRI's Research Programme in the Field of Ecological Protection and Control during 1990

Some research in the field of ecological protection and control is going on at PCRI but its scope is limited. Few new research activities have started since I visited the Institute in November - December 1987. None of the project proposals in my report has been finalized even though the planning has proceeded somewhat. The PCRI staff has also identified and started the planning of some additional project ideas. It is evident that PCRI's resources to a large extent have been devoted to the EIA Conference during 1988.

I strongly recommend PCRI to intensify its research activities in the field of ecological protection and control during 1989. Some new research projects have to be started to keep the staff busy and increase its scientific competence. It is also important to show some scientific results before the first phase of the PCRI project ends. Highest priority should be given to projects which contribute to the build-up of a competence which can be used commercially. Two new research projects which fulfil these requirements are described in Annex 2. They are in a final stage of planning and seem to stand a fair chance to be funded. It is vital to PCRI that these projects are implemented as soon as possible.

If a choice between the two projects has to be made, priority should be given to "Development of a methodology for environmental assessment and management planning of industrial areas". This project is based on one of the project ideas which I identified in 1987 (Long term ecological and environmental monitoring of the Shivalik Hills Area). The study area has been limited to the BHEL industrial estate at Ranipur, Hardwar, and a management component has been added.

Three other project ideas were identified in 1987. They are still of interest to BHEL but the work to develop them into project proposals has not started yet. They can hardly be implemented in 1989 but it is vital that these projects are not given up because they will give PCRI a competence which may be of commercial value in the future.

Some additional project proposals were also presented to me for judgement. In my opinion they should not be implemented at present. The main reasons for this conclusion are PCRI's lack of resources and the lack of scientific justification, relevance and cogency of one or two of the projects. These projects are.

- Environmental impacts analysis of Bhopal. Computer aided information and decision support system for effect of methyl isocyanate

- Assessment of the impacts of SO_2 point source on growing vegetation and means for reduction of its injury to vegetation

- Development of pilot plant for treatment of BHEL industrial effluent through water hyacinth

- Utilization of electroplating waste as insecticides

4. PCRI s Staff in the Field of Ecological Protection and Control

The present staff of PCRI includes one person - Dr. N.G. Shrivastava - with a Ph.D.-degree in Ecology (Limnology) and several persons with a basic ecological competence. Dr. (Mrs) N.S. Srivastava has a Ph.D.-degree in Biochemistry. However, to be able to fulfil its tasks, the Institute needs a strengthening of its staff in the sector of ecological protection and control. This is particularly true for the fields of terrestrial ecology, geology and hydrology. In 1987 I was informed that this situation would soon be somewhat improved because a position as geologist was under recruitment. Unfortunately, this recruitment is still not finalized and it is strongly recommended that it be speeded up.

The researchers and technicians who work with ecological protection and control are well-educated, capable and dedicated. However, they are few and have a limited experience as planners and leaders of comprehensive research projects. Therefore, further scientific advice, guidance and supervision in the field of ecological protection and control is urgently needed. This need can only partly be satisfied by consultants and the lack of senior researchers is a major shortcoming to PCRI. It is strongly recommended that a strengthening of the staff by recruiting some senior researchers be considered. It is also recommended that scientific advice and guidance be given on a consultancy basis. A strengthening of this function can also be brought about by a cooperation with a research institute abroad.

There is also a need for additional training of existing staff in ecological protection and control, particularly in applied environmental sciences, field work methodology and remote sensing technique. Therefore, it is strongly recommended that seminars and other in service training activities in this field be accomplished. It is also recommended that researchers from PCRI be sent to other institutions in India and abroad for specialized training.

For the immediate future I recommend training in remote sensing technique at Dehra Dun (Indian Institute of Remote Sensing) for

two or three researchers (among others Dr. N.C. Shrivastava). Regarding training abroad, I have been asked to draw up training programmes for Dr. N.C. Shrivastava and Dr. (Mrs) N.S. Srivastava.

Training programme for Dr. N.C. Shrivastava

After consultation with Dr. Shrivastava and the Management of PCRI some areas where he needs further training have been identified. They are as follows:

- Environmental management with special reference to
  - o environmental impact assessment;
  - o environmental planning; and
  - o environmental decision support systems.

- Water and air pollution: biological effects and methods for monitoring and control, with special reference to
  - o effects of different pollutants, toxic substances etc. on terrestrial and aquatic ecosystems;
  - o biological methods for environmental monitoring, mainly quality of air and water; and
  - o biological methods for control of water pollution.

- Environmental research techniques and methodologies, with special reference to
  - o studies of effects of air pollutants (SO_2, NO_x, ozon etc.) on plants and
  - o utilization of an electron microscope.

- Ecological modelling, with special reference to models comprizing environmental dynamics.

Given the limited time available for training abroad (2-3 months) and the wide scope of the identified areas, it is evident that a meaningful training can not be provided in all these areas. Priority has to be given to one or two areas. Having considered Dr. Shrivastavas wishes and PCRI's needs (especially as regards building up a competence which can be used commercially) I have come to the conclusion that his training abroad should be concentrated on environmental management, especially environmental

impact assessment (EIA). Post-graduate courses in EIA of 2-3 months length will be given next year by Manchester University and by University of Aberdeen, UK. I recommend that Dr. Shrivastava be sent to one of these courses.

Traning programme for Dr. (Mrs) N.S. Srivastava

After consultation with Dr. Srivastava and the Management of PCRI some areas where she needs further training have been identified. They are as follows:

- Pollution control technologies, with special reference to methods to reduce emissions from various industries, e.g.
  - o distilleries,
  - o pesticide factories;
  - o electroplating shops; and
  - o fertilizer plants.

- Ecological modelling, with special reference to emissions of waste water.

- Plant tissue culture technique.

- Utilization of industrial and agricultural waste, with special reference to production of single cell protein and recycling/recovery of metals and chemicals.

Given the limited time available for training abroad (2-3 months) and the wide scope of the identified areas, it is evident that a meaningful training can not be provided in all these areas. Priority has to be given to one or two areas. Having considered Dr. Srivastavas wishes and PCRI's needs (especially as regards building up a competence which can be used commercially) I have come to the conclusion that her training abroad should be concentrated on waste water treatment technologies. I recommend that Dr. Srivastava be sent for training abroad at a well reputed university or research institute which can give a general overview of waste water treatment as well as practical in-depth knowledge of some technologies (especially biological and biochemical) of specific interest to PCRI (e.g. industrial

branches mentioned above. There are several equivalent alternatives and I suggest that inquiries be sent to:

- Pollution Research Unit, Manchester University, Manchester, UK

- Department of Civil Engineering, University of Newcastle, Newcastle-upon-Tyne, UK

- Water Research Centre, Medenham, UK

- Department of Chemical Engineering, University of California, Davis, USA

5. Some Shortcomings and Problems of PCRI

In this chapter problems and shortcomings of PCRI (except for personal matters) and ways to improve the situation will be discussed.

Research in the field of ecological protection and control is highly dependent on access to laboratory facilities. The laboratories of PCRI fulfil the greater part of the requirements from this sector of research but some supplementing is necessary. The report from my mission to PCRI in 1987 includes a list of additional equipment (both for field investigations and for laboratory analyses) which is required. Unfortunately, none of the required equipment had been acquired one year later. The recommendation to start the acquisition immediately is therefore repeated.

Scientific research demands direct access to basic literature and easy access to specific literature on request. It is also greatly facilitated by access to computerized systems for literature search. PCRI lacks all these facilities at present which is a major drawback in its research work. The library of PCRI contains only a few basic text books, handbooks etc. in the field of ecological protection and control. Basic journals and periodicals are almost completely missing. The report from my mission to PCRI in 1987 includes a list of basic literature which was recommended to be added to the library. Unfortunately, none of the required literature had been acquired one year later. The recommendation to start the acquisition immediately is therefore repeated.

A problem which soon runs the risk of making the scientific work of PCRI more and more difficult is the insufficient maintenance of buildings, laboratories etc. This was discernible in 1987 and had deteriorated considerably in 1988. An improved maintenance is necessary.

Scientific work benefits from cooperation between researchers, between institutes, departments etc. and between countries. It is of particular importance for an institute like PCRI,

which is newly established and has few researchers at senior level, to work in close contact with other scientific bodies within and outside India. However, PCRI is rather isolated which contributes to the slow progress of its scientific work. Therefore, I strongly recommend PCRI to increase its cooperation both at national and international levels. Especially, a cooperation with an institute, university etc. in an industrialized country could mean a much needed strengthening of PCRI's capacity to plan and conduct comprehensive research projects.

Finally, it has to be underlined that the limited funds which are available to PCRI restricts its scientific work, especially as regards the possibilities to start new research projects.

6. PCRI's Long-term Activities

It is strongly recommended that PCRI choose environmental management as a future priority area, both as regards research and consultancies. If PCRI manages to build up a competence in this field huge commercial opportunities will probably turn up in the future. Environmental management includes environmental impact assessment, environmental planning and similar activities aiming at conservation of the environment. To begin with priority has to be given to industrial and power plants respectively industrial and urban areas where PCRI has a certain competence today. However, it is recommended that the whole field of environment be covered in the long run. This means, for example, that environmental impact assessment of dam construction projects and regional environmental planning can be carried out by PCRI. There is a great - and increasing - need for independent consultants in this field. The rapidly increasing need for planning and assessment of multipurpose dam projects (hydropower, flood control etc.) in India should be particularly underlined. The broad competence (including land use, soil erosion, siltation etc.), which is a precondition for a consultant in this area, has to be built up gradually within PCRI by research, practical work, supplementing of staff etc.

The proposed activities of PCRI during 1989 will contribute to the build-up of the Institute's competency but further measures have to be taken. One further step of great importance is a research project aiming at the development of an afforestation and erosion control management support system. It is at present planned by the Swedish University of Agricultural Sciences and IIASA. See Annex 3. The planning of the project includes identification of potential donors ouside India.

Annex 1

ENVIRONMENTAL IMPACT ASSESSMENT OF INDUSTRIAL DEVELOPMENT PROJECTS. SOME PROBLEMS FACED IN NORDIC AID PROGRAMMES

A paper presented at the International Conference on EIA for Developing Countries, New Delhi, India, Nov. 28 - Dec. 2 1988

Environmental Impact Assessment of Industrial Development Projects

Some Problems Faced in Nordic Aid Programmes

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Per Wramner

Environmental Impact Assessment of Industrial Development Projects. Some Problems Faced in Nordic Aid Programmes

Summary

The paper describes the concept of environmental impact assessment (EIA) in general and with specific reference to development assistance programmes and projects. The rapid progress all over the world for EIA as an instrument to bring about an integration of environment and development is underlined.

The development of EIA of Nordic aid projects is analysed. It is noted that EIA is not a regular procedure in any Nordic country, even though work to bring this about is in progress in most of the countries. The lack of EIA has caused negative environmental consequences and a case study (Mufindi pulp and paper mill in Tanzania) is presented.

It is concluded that the Nordic countries aspire to pay greater heed to the environmental aspects of their development assistance but are encountering manifest difficulties in their efforts to convert aspirations into practical action. One reason for this is the lack of a compulsory EIA of aid programmes and projects which may affect the environment negatively.

The EIA-procedures have largely been developed in the industrialized countries and for large-scale projects (e.g. industrial development). Problems have come up when EIA has been applied to Nordic development assistance which have delayed its introduction. The problems are due to the different ecological and socio-economic conditions and the predominance of agricultural and rural development projects. Also EIA of industrial aid projects has made slow progress due to these circumstances.

The Nordic experiences indicate that an EIA-procedure, also in the industrial field, should be flexible and informal, in contrast to the standardized, static approach which predominates in many parts of the world.

Introduction

Many developing countries face serious environmental problems (including exhaustion of natural resources) which are increasing both in extent and intensity. The environmental deterioration makes it more and more difficult to provide for basic human needs (food, water, fuelwood, etc.), affects the health situation negatively and constitutes an obvious obstacle to development. Pollution and poisoning from industrial sources constitute a substantial part of the environmental degradation in many areas.

The environmental problems of the developing countries have to be attacked in several ways. One of these ways is to see that development projects pay greater need to the environment. This has to be done both by avoiding or minimizing negative side effects, and by carrying out specific activities in the field of conservation and rehabilitation.

One major element in the endeavours to get development projects to pay greater attention to the environment is to carry out a proper environmental impact assessment (EIA). This means that all projects which may affect the environment are assessed at the earliest stages of project formulation.

EIA is a procedure for encouraging decision-makers to take account of the possible effects of development investments on environmental quality and natural resources productivity, and a tool for collecting and assembling the data which planners need in order to make development projects more sustainable and environmentally sound. EIA is usually applied in support of policies for the sustainable and equitable use of natural resources and the prevention of environmental degradation (Wramner 1987).

The Concept of Environmental Impact Assessment (EIA)

EIA is a wide concept which has been given various definitions. EIA has also been utilized for various purposes in various situations. Common to all definitions is that EIA is a measure

which aims at finding out environmental effects of proposed projects, programmes and other activities which affect, or may affect, the environment (including the natural resources base). Usually, EIA also aims at finding out what can be done to avoid or minimize negative environmental effects (Wramner 1987).

EIA is usually part of a process. The EIA process refers to a wide range of activities preceding and following the assessment itself. The process might begin, for example, with an initial screening exercise to determine whether a full EIA is required or not. After the assessment has been prepared and a decision taken, the process can continue through programmes of monitoring and evaluating the environmental effects of the activity during and after implementation.

EIA is typically both a tool for analysing environmental effects and a procedure for bringing this analysis to bear on decisions. The overall objective is to ensure that development does not cause non-acceptable environmental damage and reduction of the productivity of natural systems. EIA, in itself, does not solve problems or substitute for the formulation and implementation of appropriate policies.

It has to be stressed that EIA is not enough to bring about environmentally sound industrial projects. Unless it is incorporated early enough in the project cycle to influence planning and design, and unless its results play a part in decision making, the effort is in vain. Therefore, EIA as such, does not solve the typical environmental problems associated with certain types of industrial development projects. It just provides systematic predictions and assessments of effects (Wramner 1987).

EIA aims at ensuring that the necessary questions are asked, and providing a technique for receiving the relevant data and analysing the information for solving environmental problems. Regardless of the overall institutional context, there is often a bias toward engineering and economic analysis of a project. EIA counteracts this bias. It is rarely easy to introduce EIA early enough in the process of identifying options and

and examining the feasibility of proposed projects so that it can be comfortably incorporated in design and implementation decisions.

As a result, EIA is often geared to influencing the various decision points in the project cycle and providing technical guidance for project preparation, giving criteria for project design, an action plan for environmental management to be included in the project agreement, or a basis for evaluating the environmental consequences of a completed project.

The United Nations Environment Programme has decided on goals and principles for EIA. It is defined as "an examination, analysis and assessment of planned activities with a view to ensuring environmentally sound and sustainable development" (UNEP 1987).

The goals and principles (4 and 12 in number respectively) are necessarily general in nature, but lay down the importance of EIA as a tool for environmentally sound projects and programmes. A basic goal is to establish that, before decisions are taken on activities which are likely to significantly affect the environment, the environmental effects of these activities are taken fully into account. The principles cover various aspects of EIA and stress, inter alia, the necessity for rules deciding when and how to carry out EIA.

One principle is that EIA should include, at a minimum:

a/ a description of the proposed activity;

b/ a description of the potentially-affected environment, including specific information necessary for identifying and assessing the environmental effects of the proposed activity;

c/ a description of practical alternatives as appropriate;

d/ an assessment of the likely or potential environmental impacts of the proposed activity and alternatives, including the direct, indirect, cumulative, short-term and long-term effects;

e/ an identification and description of measures available to mitigate adverse environmental impacts of the proposed

activity, alternatives, and an assessment of those measures;

f) an indication of gaps in knowledge and uncertainties which may be encountered in compiling the required information;

g) an indication of whether the environment of any other State or area beyond national jurisdiction is likely to be affected by the proposed activity and alternatives;

h) a brief, non-technical summary of the information provided under the above headings.

General Application of EIA in Development Assistance Projects

EIA has become widely applied around the world in recent years. A majority of developed countries have taken various steps in carrying out EIA of their domestic projects and programmes. An increasing number of developing countries are also initiating EIA procedures, particularly in Southeast Asia, where about half the countries have legal requirements and three-quarters have conducted EIAs. South Asia, the Middle East and Latin America are also making progress, while EIA is less developed in Africa.

... approaches to EIA taken by various countries differ widely in terms of their legal/institutional base, focus, scope and procedures. Generally speaking, however, one can distinguish between an informal-implicit and a formal-explicit approach. There is a tendency to move from the former to the latter approach (Wramner 1987).

The application of EIA to development assistance activities is much less advanced than for domestic development, but considerable progress has been made recently and the process continues rapidly. However, EIA is, for the most part, done on an ad hoc basis. In most donor countries, aid agencies use discretion in deciding whether or not to perform such an assessment.

The Organization for Economic Co-operation and Development (OECD) has made a study on EIA of development programmes and projects. OECD has also recommended its member countries to incorporate an EIA-procedure in the planning of its development assistance programmes and projects (OECD 1986).

The importance of EIA as a tool to bring about development activities which are compatible with environmental requirements is underlined by OECD. There is a need for EIA in a wide range of programmes and projects which are outlined in a check list. It includes industrial activities (e.g. metallurgical plants, wood processing plants, chemical plants, power plants, cement plants, refinery and petrochemical plants, agro-industries), extractive industries (e.g. mining, quarrying, extraction of peat, oil and gas), waste management and disposal (e.g. sewerage systems and treatment plants, waste landfills, treatment plants for household waste and for hazardous waste), infrastructure and exploitation of hydraulic resources.

Constraints to carrying out EIA in developing countries have been identified by OECD (1986) and are as follows:

a/ insufficient political awareness of the need for environmental assessment;
b/ insufficient public participation;
c/ lacking or inadequate legislative frameworks;
d/ lack of an institutional base;
e/ insufficient skilled manpower;
f/ lack of scientific data and information;
g/ insufficient financial resources.

The OECD member countries are recommended to assist recipient countries to overcome these constraints.

Application of EIA in Nordic Development Assistance Projects

In a report by a Nordic working group set up by the Nordic Council (Wramner et.al. 1983), the interrelation between the environment of developing countries and the development assistance of the Nordic countries is discussed. It is noted that all the Nordic countries have declared that they aspire to pay more attention to the environmental aspects of their development assistance. However, it is also noted that all the countries are finding it hard to live up to these stated aspirations in the practical implementation of development cooperation. EIA is generally not used as an instrument to bring about an integration of environment and development.

In the report it is strongly recomended that the Nordic countries, together with the recipient countries, should incorporate the environmental aspects at as early a stage as possible into the planning of development assistance programmes and projects. When doing so, use should be made of, inter alia, EIA.

The situation in the Nordic countries as regards EIA of aid projects a few years later is described by OECD (1986).

In Denmark, EIA is an essential component in the appraisal and evaluation of many DANIDA (Danish International Development Agency) financed projects. However, DANIDA has not yet participated in the preparation of environment profiles or financed any major environmental impact statements in developing countries. A working group of DANIDA and the Ministry of the Environment has identified six main types of projects for which an EIA should be prepared.

In Finland, EIA is being introduced as an element of the preparation of development assistance projects financed by the Finnish aid agency FINNIDA. The Ministry for Foreign Affairs has set up a permanent working group in cooperation with the Ministry of the Environment. The aim of the working group is to improve the procedures and methods for incorporating environmental aspects into development cooperation projects and programmes.

In Norway, decisions on projects which require an EIA are taken on a case-by-case basis by the responsible project officer in NORAD (Norwegian Agency for International Development). No decision has yet been taken on how to identify which projects are most in need of environmental assessment. A joint body of the Ministry of Development and of the Ministry of Environment is presently dealing with the issue of introducing a screening procedure for projects requiring an environmental assessment.

In Sweden, SIDA (Swedish International Development Agency) has no formal procedures for EIA. Environmental considerations are instead given on an ad hoc basis to a growing number of aid projects both in the planning process and in the follow-up and

evaluation of the projects. SIDA's capacity to take care of environmental aspects in development assistance has been increased by the recruitment of an environmental adviser in the central office.

OECD's examination showed that EIA of aid programmes and projects was not a regular procedure in any of the Nordic countries in 1986. This means that all the countries have showed a striking slowness as regards the implementation of the EIA-recommendation of the Nordic working group which was made in 1982 (Wramner et al. 1983).

A Nordic workshop on EIA in development assistance was held in Finland in 1988 (Johansson 1988). The current situation in the Nordic countries was presented and discussed. It can be summarized as follows.

In Denmark, a plan of action for strengthening the consideration of environmental aspects in official development assistance is being drawn up. It will include guidelines for planning aid projects. The issue of ensuring appropriate environmental screening of all projects is being considered, but this work is still in progress (Richter 1988).

In Finland, a set of draft guidelines for EIA of development assistance projects have been worked out. The use of them proceeds in steps depending on which phase of the project cycle is in question. In the initial fact-finding and negotiating stages OECD's check list may be used for making a rough environmental assessment. When working out the Terms of Reference for the preparation of a project document, a matrix may be used as a check list of potential environmental effects of the project. During the preparation of the project document the identified risks may be scrutinized against screening tables. The guidelines were discussed at the Nordic workshop and are now being revised with regard to the outcome of the discussion. They turned out to be too static, technical and general for industrial projects (Haldin 1988, Wramner 1988).

In Norway, an EIA-system is being worked out. It is designed for use in the routine planning and administration of development aid projects and consists of three stages, namely initial screening of projects, initial environmental evaluation and full assessment (Kristoffersen 1988). One booklet for the initial screening of projects, consisting of check lists for each project category, has been produced (Norwegian Ministry of Development Cooperation NORAD 1988). Booklets for each project category consisting of general information and guidelines for the initial environmental evaluation as well as a booklet consisting of guidelines for the full assessment will be produced.

In Sweden, the environmental aspects of development assistance have recently been given increased weight. The Parliament has decided to add environmental considerations to the main objectives of Swedish development assistance. However, no work aiming at incorporating EIA as a compulsory component in the preparation of programmes and projects, which may affect the environment negatively, has yet started.

The conclusion is that the situation has improved somewhat since 1986 but is still not satisfactory. The progress is remarkably slow. The long discussed idea of a compulsory EIA of aid programmes and projects, which may affect the environment negatively, is far from being realized. Such programmes and projects may still be approved without having been subject to an EIA in all the countries.

Consequences of the Lack of EIA

The consequences of the lack of EIA of Nordic aid programmes and projects have not been studied systematically. However, available information from all the Nordic countries indicates that negative environmental consequences, which could have been avoided or reduced with the help of an EIA, has occurred in a number of cases.

One example, which has been studied scientifically, is the establishment of a large integrated pulp and paper mill in the Mufindi District of Tanzania. SIDA was one of the donors and

the Nordic Investment Bank one of the lenders to the project. The environmental effects are summarized by, inter alia, Christiansson and Ashuvud (1985).

The Tanzanian Government formally authorized the construction of the mill in 1977. The decision was based on a very limited knowledge of the environmental effects. The feasibility study did not take up any potential ecological effects. Uncertainty regarding these external effects did not, however, delay the authorization of the project and support by donors.

Some environmental investigations were made later on, but a proper EIA was never carried out. Most of the environmental effects remain to be seen. Not until the mill has been in full production for some time, which is not yet the case, will the total impacts on the environment be discerned.

The establishment of the mill strongly influences the natural environment. Four types of impacts can be discerned:

- Immigration and urbanization cause increased pressure on and competition for land, water, building material, energy, etc.

- Unavoidable air and water pollutants affect the natural and agricultural ecosystems. These effects include acidification of soils and possible damage of tea plantations caused by sulphur dioxide and other emissions into the atmosphere and reduced fish catch and deteriorated domestic water supply caused by effluents of waste water containing oxygen demanding and toxic substances.

- Increased food requirements cause intensification of agriculture (including animal husbandry) and clearance for cultivation of areas covered by grass, bush or woodland which results in land degradation.

- The mill presupposes forestry operations which affect the environment in several ways. The sustainable supply of wood is an issue of crucial importance which is closely linked to the environment.

The negative environmental consequences of the mill may be far-reaching and may cover vast areas. Production, human life etc. may be drastically affected. At least some of these consequences could have been avoided or reduced if they had been known and taken into consideration in the planning phase of the project. Others are inevitable but a better picture of them, when it was decided to establish the mill could have contributed to a better decision (Christiansson and Ashuvud 1985).

Discussion

It is evident that the Nordic countries aspire to pay greater heed to the environmental aspects of their development assistance. The aid authorities have got clear political directives to improve the integration of environment and development and have decided to take a series of steps to bring this about. However, this new policy has only had a limited impact on the concrete acting at the programme and project levels. The Nordic aid authorities are encountering manifest difficulties in their efforts to convert their environmental aspirations into practical action. One reason for this is the lack of a compulsory EIA-procedure. It is remarkable that such a procedure has not been introduced in any of the Nordic countries up to now. Several other circumstances also contribute to the current situation.

When analysing the difficulties in the Nordic countries it is essential to remember that the corresponding difficulties - often considerably aggravated - exist on the recipient side. It is the interrelation between donor and recipient which ultimately determines the outcome in practise (Wramner et.al. 1985).

Many of the problems which are faced in the attempts to introduce EIA are common to the whole environmental sector. One such problem of basic importance is that environmental questions have only been to the face in development assistance context for a short time. Not until the last decade did we obtain more detailed knowledge (nevertheless far from comprehensive) on the interrelation between the environment and development. A more general awareness of this interrelation has not become mani-

fest until recently and is still frequently missing, especially in the development sphere. Many of the problems that have arisen must be seen in the light of this circumstance (Wramner et.al. 1983).

The recipient-oriented development assistance policy of the Nordic countries has also been an obstacle in this context. The recipient countries have up to now only rarely asked for assistance in the environmental field or for commitments in which special heed would be paid to environmental considerations. However, this attitude seems now to be changing rapidly.

The lack of sufficient knowledge of ecological conditions and the environmental situation in many developing countries does not facilitate an integration of environment and development. There is also a lack of know-how and experience in the various bodies which are involved in development assistance activities. Environmental conservation spans over many sectors and a large number of people with widely varying background are affected by its issues.

Over and above the problem of the general level of knowledge, there are problems caused by the fact that there are not enough environmental experts in the development assistance administrations. Nor are these bodies generally organized in such a way that they make it easy for environmental aspects to be brought to the fore.

Many problems also arise because the perception of environmental question is too narrow. Especially in the practical work, people are often not entirely clear about the importance of an integrated approach and about the interrelation between population, natural resources, environment and development. Environmental issues are regarded more or less as purely technical questions having no relation to the social cultural, political, etc. conditions which on many occasions are extremely decisive. In these cases purely environmental measures are not sufficient but the social and other problems must also be grappled with if the intended outcome is to be obtained. Here collaboration between those representing environmental consi-

derations and other sectors is required (Wramner et.al. 1983).

In addition to the general obstacles to a better integration of environment and development in the foreign aid of the Nordic countries, which do not facilitate the introduction of EIA, some specific problems regarding EIA will be discussed

The EIA-procedures have largely been developed in the industrialized countries and for large-scale projects (e.g. industrial and infrastructural development). This creates a risk of putting importance to wrong issues when applying EIA to development assistance. The ecological and socio-economic conditions in developing countries differ considerably from those in industrialized countries. The emphasis of Nordic foreign aid lies within the sector of agricultural and rural development. In this sector the concept of EIA is less developed and more difficult to apply than in the industrial sector (Wramner 1987). These circumstances have contributed to the slow progress of EIA in Nordic development assistance (including programmes and projects in the industrial field).

The Nordic aid authorities have met with technical problems in their endeavours to develop EIA-procedures. The standardized, static approach to EIA, which predominates in many countries, has proved to be of limited value to Nordic aid programmes and projects, also in the industrial field (Haldin 1988, Wramner 1988). The Nordic experiences indicate that an EIA-procedure should be more descriptive, flexible and informal than some of the procedures which have been developed recently. This applies specifically to programmes and projects in the field of agriculture and rural development but also to industrial and infrastructural activities.

Check lists, manuals, etc. may facilitate the accomplishment of EIA. The preparation of such means may contribute considerably to the introduction of EIA as an integral part of the planning of aid programmes and projects. However, too rigid and detailed forms, matrices, etc. may have the opposite effect and should be avoided in EIA-procedures (Wramner 1987).

Finally, it has to be underlined that the slow introduction of EIA in Nordic development assistance also is due to insufficient priority given to this issue both at governmental level and at aid agency level. Strong directives, sufficient budgetary allocations and involvement of qualified expertise would certainly have resulted in a much faster progress than has now been the case.

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Annex 7

PROPOSED RESEARCH PROJECTS DURING 1989

1 DEVELOPMENT OF A METHODOLOGY FOR ENVIRONMENTAL ASESSMENT AND MANAGEMENT PLANNING OF INDUSTRIAL AREAS

Objective

The overall objective of the project is the development of a general and standardized methodology and procedure of rapid environmental impact assessment for local to regional industrial activities and their surroundings, including population, infrastructure and the natural resource base. Using simple yet efficient methods such as check lists, cross-impact matrices, selected indicators and possibly simulation models, this methodology will form the basis for the formulation of local pollution control and environmental management plans.

The main project components can be specified as follows:

1. To develop methods and approaches for a rapid survey and summary characterization of present and past environmental and ecological conditions, in particular the pollution of air, water, soil and biota.

2. To develop methods and tools to assess and analyse present and past industrial, urban and rural activities and their related socio-economic conditions in their impact on the environment and ecosystem of an area.

3. To develop standard methods to formulate pollution control and environmental management plans to improve living conditions around industrial activities on an ecologically sustainable basis.

The development of this methodology as a "tool kit" in PCRI will enable the Institute, on a consultancy basis, to perform such assessments for industries, municipalities and governmental bodies and would therefore be of considerable commercial potential.

Methodology

A comprehensive survey and analysis of the project area will be made for collection of data related to the environmental and socio-economic conditions. Both present and past conditions will be studied. The parameters include, inter alia:

- Geology
- Vegetation
- Ground water hydrology and quality
- Surface water hydrology and quality
- Air quality
- Pollution of soils and biota
- Land degradation
- Fisheries

The socio-economic parameters include demography, migration, occupation, income, public health, land use etc.

The environmental consequences of industrialization and urbanization will be analysed with specific reference to interrelations between various environmental parameters and various components of the industrialization/urbanization process. Based on the analyses measures to improve the environment will be identified. Alternative environmental management plans will also be drawn up.

Scope of project

The development of methodology for environmental assessment and management planning of industrial areas has to be based on a case study. The BHEL industrial estate at Ranipur, Hardwar, has been selected for this purpose.

The BHEL industrial estate at Ranipur affects its environment in several ways, both directly and indirectly. The environment is directly affected by emissions of air and water pollutants, by noise disturbances, by solid waste dumping, by natural resources exploitation etc. The BHEL industries also affect the environment indirectly in similar ways by impacts caused by the BHEL township and the subsequent concentration of people

and various human activities to its surroundings.

The environmental deterioration in and around the BHEL township affects the industrial production negatively in several ways. The natural resource base (e.g. ground water) is degraded, the health situation of the BHEL staff is deteriorated etc.

The project will not only result in a methodology which can be applied in other areas and has a great potential commercial value to PCRI. It will also result in an environmental management plan which shows what can be done to improve the environment of the BHEL industrial estate at Ranipur and its surroundings.

The methodology for environmental assessment and management planning, which will be developed, is based on an integrated approach. A main component will be a system for providing technical and scientific information about the environment in a form which is suited to planners, politicians and other non-professional decision makers.

Justification and feasibility

Planning for a sustainable development needs a large amount of information about the environment. The methodology for environmental assessment and management planning, which is a major outcome of the project, can be applied in other industrial and urban areas in India and abroad. There is a great need for such assessment and planning in many places. Therefore, with the methodology and expertise developed, the potential for PCRI to be established as a commercial consultant in this field is considerable. This project is of specific interest by developing an integrated system to make the scientific basis for environmental planning and management directly available to non-professionals.

The BHEL industrial estate at Ranipur is well suited for this study. It has given rise to a wide range of environmental problems which need to be tackled. Most of the problems are typical to industrial and urban areas. As a secondary outcome the project will give the necessary basis for measures to

improve the environmental situation in the study area.

The project will be carried out by the staff of PCRI and will mainly use equipment available at the institute. Some additional funds are required and will be applied for.

II PRODUCTION OF HYDROGEN FROM BIOMASS AND WASTE

This project is in an earlier stage of the planning process than the previous one. Only a first outline can be presented here. However, the project is limited in scope and size and the planning can be finalized within a few weeks.

The project is a laboratory study which will indicate if the bromination process is applicable to a variety of biomass and organic wastes for the production of hydrogen. This is a new method for the production of hydrogen which may have commercial potentials if PCRI manages to make the process efficient and cost-effective.

The bromination reaction is exothermic and can supply most of the process heat. Feedstocks with up to 44 % water can be used because of the water consumed in the reaction. The process shows promise because of the its high potential thermal efficiency and its applicability to a broad range of feedstocks, particularly those with a high water content.

Chemically, the process can be described as follows:

$$C_6H_{10}O_5 + 7H_2O + 12Br_2 \rightarrow 24HBr + 6CO_2$$

$$24Br \xrightarrow[\text{lysis}]{\text{electro-}} 12H_2 + 12Br_2$$

The feedstocks, which will be tested, include conifer, cane, fresh water hyacinth, kelp (a salt water plant), bagasse (sugar cane waste pulp) and aerobically digested sewage samples.

The project will be carried out by the staff of PCRI and will mainly use equipment available at the institute. Some additional funds are required and will be applied for.

Annex 5

AFFORESTATION AND EROSION CONTROL MANAGEMENT SUPPORT SYSTEM

A research project outline

COLLABORATIVE R&D PROJECT PROPOSAL
Swedish University of Agricultural Sciences at Uppsala
IIASA, Laxenburg, Austria
PCRI, Hardwar, India

APPORESTATION AND EROSION CONTROL MANAGEMENT SUPPORT SYSTEM

OBJECTIVES:
- to develop and implement computer based tools to assist in the design, implementation, monitoring, and evaluation of afforestation programs and erosion control measures in parts of the Himalyan region in Northern India;
- establish and train an associated team of Indian experts and a local technical support group for the system.

PROBLEM BACKGROUND:
Deforestation, and resulting soil degradation and erosion on forest, range and arable land, reservoir siltation, and flooding, are among the most urgent environmental problems in parts of India, in particular in the Himalayan region. These problems can and do severely effect regional and national development efforts.
Major afforestation and erosion control pograms require far reaching decisions with long-term consequences for a complex, dynamic, and spatially distributed extensive environmental system, that at the same time effects and is effected by the socio-economic development.
Scientifically based methods of managing large-scale control and amelioration programs, using modern computer technology in support of classical scientific methods, can help to improve the information basis for planners and managers, and thus improve the effectiveness of such programs.
A growing awareness of the importance of vegetation cover, resulting in recent legislation in India, as well as an increasing emphasis on hydropower -- that can be severely affected by reservoir siltation -- makes the proposed project a timely complement to ongoing and planned development projects.

METHODS AND APPROACH:
A computer based information, simulation, and decision-support system (DSS), combining Geographical Information System (GIS), remote sensing, and simulation modeling techniques with concepts of Artificial Intelligence (expert systems technology), multi-criteria DSS, and interactive computer graphics, into an easy-to-use support tool for planners and managers, adapted to local conditions and constraints, will be developed.
The development will be based on data from a selected area in Utta Pradesh and/or Kashmir, which offer a number of representative catchments.

The development and testing of the software system and its component data and knowledge bases will go hand in hand with on-the-job training of Indian staff at the collaborating institutions, to ensure self-reliance in the use of the system after its implementation in India.

Ideally, the system would be developed within the framework of an ongoing major affforestation program or similar project.

REQUIRED EFFORT:
approx. 4 development man-years per year for software development, testing, and implementation, over three project years;
approx. 4 man years for the collection and adaptation of data and domain specific expertise.

MAJOR SYSTEMS COMPONENTS:
A geographial information system (GIS) on orography, landuse, settlements and infra structure, soil, vegetation cover, including

the integration of remote sensing data (LANDSAT TM, SPOT and the recently launched Indian IRS-1A) for detailed and timley information updates;

Interactive data bases on landuse, hydrology, climate, forest stands, population (fuel wood consumption, commercial and industrial use of wood), livestock (grazing), etc.

Interactive simulation models for forest development and forest management, soil conservation, and forestry, rain-runoff, soil erosion, sediment transport and reservoir siltation, flood control, hydropower and irrigation.

A socio-economic development model to describe population and grazing pressure, rural fuel use, and commercial/industrial use of wood.

DSS component for the comparison of alternative management scenarios, comparison of different systems evolution (in time and space), evaluation of scenarios under climatic uncertainty.

COLLABORATIVE STRUCTURE:

The Swedish University of Agricultural Sciences at Uppsala would provide the scientific coordination of the study and the necessary domain expertise; IIASA would provide systems analysis and computer expertise and undertake the software development; PCRI would collect and organize the necessary field data in collaboration with local Indian agencies, eg., the Forst Research Institute at Dehra Dun, secund staff for on-the-job training in Sweden and at IIASA, and finally install and maintain the software system at PCRI for further local use.

Various Indian institutions such as the Forest Research Institute, Regional Remote Sensing Service Center, etc., that are all located in Northern India in or near the Himalayan foot hills, would be involved in th study to provide data and local expertise.