REGIONAL SEAS

UNITED NATIONS ENVIRONMENT PROGRAMME

Environmental impact assessment in the United Arab Emirates A case study: Ruwais and Zirku industrial areas

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PREFACE

The United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) adopted the Action Plan for the Human Environment, including the General Principles for Assessment and Control of Marine Pollution. In the light of the results of the Stockholm Conference, the United Nations General Assembly decided to establish the United Nations Environment Programme (UNEP) to "serve as a focal point for environmental action and co-ordination within the United Nations system" (General Assembly resoltuion (XXVII) of 15 December 1972). The organizations of the United Nations system were invited "to adopt the measures that may be required to undertake concerted and co-ordinated programmes with regard to international environmental problems", and the "intergovernmental and non-governmental organizations that have an interest in the field of the environment" were also invited "to lend their full support and collaboration to the United Nations with a view to achieving the largest possible degree of co-operation and co-ordination". Subsequently, the Governing Council of UNEP chose "Oceans" as one of the priority areas in which it would focus efforts to fulfill its catalytic and co-ordinating role.

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans.

The Regional Seas Programme at present includes ten regions[1/] and has about 130 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activites for the management and development of regional legal agreements and of action-oriented programme activities[2/].

During its fourth session in 1976 the Governing Council of UNEP approved the preparatory work for convening a Regional Conference on the Protection of the Marine and Coastal Environment of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. Subsequently, on the basis of a fact-finding mission sponsored by UNEP and supported by several United Nations agencies, a draft action plan dealing with the scientific and socio-economic aspects for the protection and development of the marine environment of the region was prepared and reviewed by a

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1/ Mediterranean Region, Kuwait Action Plan Region, West and Central African Region, Wider Caribbean Region, East Asian Seas Region, South-East Pacific Region, South Pacific Region, Red Sea and Gulf or Aden Region, Eastern African Region and South Asian Region.

2/ UNEP: Achievements and planned development of UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies. UNEP Regional Seas Reports and Studies No. 1. UNEP, 1982.

series of technical meetings of Government-nominated experts. In April 1978 a Regional Conference of Plenipotentiaries was convened in Kuwait for the purpose of reviewing, revising and adopting the action plan and related legal instruments. The Conference adopted on 23 April 1978 the Action Plan for the Protection and Development of the Marine Environment and the Coastal Areas of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates3/. The Action Plan has subsequently become known as the Kuwait Action Plan.

Within this Action Plan, the Governments have approved a number of projects and assigned priority to some of them. UNEP has provided its technical backstopping and support for the implementation of these projects, in co-operation with a number of specialized agencies as appropriate.

In this context, the Government of the United Arab Emirates, through its Higher Environmental Committee, approached UNEP seeking its assistance to undertake an overall environmental impact assessment of two industrial complexes in Ruwais area and Zirku Island, with a view to eliminating or reducing any detrimental environmental effects which might be caused by the industrial and the related socio-economic activities at the two sites.

In response to the above request, UNEP organized a field mission jointly sponsored by UNEP/IMO and ROPME to undertake the assessment of the environmental impact of the Ruwais industrial complex, Jabel Dhanna and Zirku Island terminals. These coastal complexes share numerous similarities with major large scale complexes in the coastal areas of the KAP Region. Therefore, lessons learned from carrying out this assessment could be used in other parts of the Region, and the results obtained thereof should serve as inputs into KAP activities in the field of coastal area development and management on an environmentally sound basis.

The present report includes a full account of the UNEP/IMO mission and its findings, as well as a description of the results of a preliminary assessment undertaken and the relevant recommendations made by the mission.

3/ UNEP: Action Plan for the protection of the marine environment and the coastal areas of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates. UNEP Regional Seas Reports and Studies No. 35. UNEP 1983.

CONTENTS

	Page
ENVIRONMENTAL IMPACT ASSESSMENT IN THE UNITED ARAB EMIRATES	1
Executive Summary and Recommendations	
Environmental Impact Assessment	1
INTRODUCTION	5
Background to the mission and broad objectives	5
Composition of the Consulting Team	6
Scope of the mission	6
SCOPE AND DEFINITION OF ENVIRONMENTAL IMPACT ASSESSMENT	6
Environmental Impact Assessment	7
Baseline studies	8
Monitoring	8
RUWAIS INDUSTRIAL AREA	9
Physical setting	9
Industries and their siting	13
Initial observations and potential environmental problems	14
ZIRKU ISLAND COMPLEX	22
Physical setting	22
Industries and siting	22
Initial observations and potential environmental problems	24
Summary conclusions concerning observations made at Ruwais and Zirku	26
ENVIRONMENTAL IMPACT ASSESSMENT AT RUWAIS AND ZIRKU	27
Approach	27
Structure	30
Organization	30
ESTABLISHMENT OF AN INDUSTRIAL AREA AUTHORITY FOR THE RUWAIS INDUSTRIAL COMPLEX	41

CONTENTS (contd.)

Page

THE FORMULATION OF POLICIES FOR THE INTRODUCTION AND IMPLEMENTATION OF E.I.A. AND POLLUTION CONTROL WITHIN ABU DHABI AND U.A.E. 43

Introduction 43
Development of environmental policies: long term strategy and interim measures 43
Pollution control 44
The role of E.I.A. in assessing new developments and major extensions to existing installations 45

INSTITUTIONAL ARRANGEMENTS TO IMPLEMENT E.I.A. IN THE U.A.E. 45

Environmental policy 46
Contingency plans for potential environmental disasters 46
Introduction and enforcement of pollution standards 47
Formulation and implementation of an E.I.A. system 47

THE FORMATION OF ADMINISTRATIVE STRUCTURE WITHIN ADNOC TO 48
MEET THE COMPANY'S ENVIRONMENTAL RESPONSIBILITY 48

EDUCATION AND TRAINING IN E.I.A. 50

Training in Abu Dhabi 50
Training outside Abu Dhabi 50

ANNEX I - UNEP/IMO MISSION SCHEDULE 51

ANNEX II - DRAFT BRIEF FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (E.I.A.) STUDY OF A MULTI-PURPOSE WATER SCHEME 53

ANNEX III - BRIEF OF A PROJECT SPECIFICATION REPORT AS USED IN THE U.K. 65

ANNEX IV - LIST OF QUESTIONS FOR DEVELOPERS AS USED IN THE U.K. 77

ANNEX V - U.S. and CANADA EPA TEST PROCEDURES FOR PETROLEUM REFINERY EFFLUENTS 83

ANNEX VI - EFFLUENT STANDARDS AND ENVIRONMENTAL QUALITY OBJECTIVES FOR WATER AND AIR USED IN A NUMBER OF OTHER COUNTRIES. 85

ENVIRONMENTAL IMPACT ASSESSMENT IN THE UNITED ARAB EMIRATES

Executive Summary and Recommendations

INTRODUCTION

A three-men UNEP/IMO mission visited Abu Dhabi during the period 22 March 1981 - 5 April 1981. The ultimate objectives of the mission were:

(i) To make a preliminary assessment of the impact of the Ruwais and Zirku industrial complexes on their surrounding environments.

(ii) Advise on appropriate measures for reducing or eliminating detrimental environmental effects.

(iii) Recommend detailed steps for conducting full-scale environmental impact assessment of Ruwais and Zirku.

(iv) Advise on long-term environmental impact assessment (E.I.A) and monitoring within the U.A.E, and the administrative and institutional structures within which it might be organized.

Enviromental Impact Assessment (E.I.A.)

Before considering the individual sites and issues within the U.A.E., the report provides an introduction to the subject of E.I.A. This explains that E.I.A is a process of determining the direct and indirect environmental benefits and disbenefits of a proposed development, including alternative sites and processes, and presenting them in an ordered and logical manner such that government departments or developers take balanced decisions on whether, and how, development should proceed. The E.I.A. process considers matters of safety, human health and social acceptability, as well as the impact on the natural environment.

A major part of the E.I.A. process is the baseline assessment (desk and field studies) which will determine the pollutant arisings from the proposed development, the state of the environment prior to development and its ability to receive pollutants without unacceptable environmental consequences. The baseline field studies can be continued as monitoring after the commissioning of plant to keep the environmental effects of the development under continual observations.

Initial observations

It was observed that the environmental effects of development of Ruwais and Zirku have not been fully considered at the planning stage. Whilst some arbitrary effluent/emission standards have been applied to individual projects at Ruwais, the additive and synergistic effects of all the projects have not been considered.

It also appears that inadequate contingency plans have been made for handling major environmental disasters or hazard events. The problems of waste disposal and the transport of hazardous materials have also been accorded insufficient importance.

At Ruwais, most of these problems stem from the independent development of projects within the complex. At Zirku the expectation of adequate dispersion of air and water pollutants provided by the island situation has resulted in potential environmental problems being given scant

Major recommendations

It is recommended that the solution to many of the problems mentioned above could be effected through the medium of E.I.A of the two sites. This will involve the following activities:

(i) Define study area/objectives.

(ii) Establish an inventory of industrial processes and a material/product balance for both present and future plans.

(iii) Carry-out a qualitative and quantitative analysis of pollution covering air, wastes, process water, losses, liquid effluents based on (ii) above.

(iv) Review existing information on environmental conditions including meteorology, hydrography, geology, oceanography (biological, chemical, physical) and living resources.

(v) Conduct a baseline assessment on environmental conditions according to needs established in (iv) above.

(vi) Elaborate programme for baseline studies of pollution based on (iii) - (v) above*.

(vii) Initiate and conduct the baseline study.

(viii) Determine environmental policies and strategies.

(ix) Establish guidelines for assessing proposed industries** including assimilative capacity of the environment.

(x) Develop regulations, guidelines and legislation for controlling environmental quality and procedures for their reassessment and modification including intercalibration.

(xi) Establish administrative and legal structures for enforcing regulations and legislation and for their modification as in (x) above.

(xii) Establish and implement environmental monitoring network based on (i) through (v) above.

(xiii) Implement environmental control regulations and the administrative structures for their enforcement and control.

The E.I.A. procedure will take approximately two years. This will require an ephemeral project team of six environmental scientists working for eight months and a field team of six environmental scientists working throughout the duration of the study. The latter team could continue their baseline studies in amended form as monitoring as long as necessary.

The conduct of E.I.A at Ruwais and Zirku could be best undertaken within the framework of the following recommendations (general recommendations are followed by specific proposals to the Higher Environmental Committee (H.E.C.) and the Abu Dhabi National Oil Company (ADNOC):

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* This should include pollutants to be monitored (e.g. CO, SOX, NOX, Trace Metals, Oil, Chlorinated Hydrocarbons etc.) as well as sample type (e.g. stack gases, liquid effluents, sediments, dust, marine biota, etc.).

** e.g. World Bank guidelines contained in "Environmental, Health and Human Ecologic Considerations in Economic Development Projects".

(i) Establish a technical branch within the Higher Environmental Committee.

(ii) Expand the capability within ADNOC for implementing environmental impact assessment in present and planned development projects including those of subsidiary or associated companies.

(iii) Determine and develop environmental policies and strategies of a federal level.

(iv) Develop guidelines, regulations and legislation for environmental control within the U.A.E., the individual Emirates and in major industrial complexes.

(v) Conduct within U.A.E. workshops and training courses on environmental impact assessment for government officials and industrialists.

(vi) Formulate and adopt contingency plans for handling environmental disasters on a federal and local level.

(vii) Consider the establishment of industrial area authorities for major complexes such as Ruwais.

The technical branch of the H.E.C. suggested in (i) above could have the following functions:

(i) Formulate policies for key environmental activities which, from the evidence available, are felt to be actually or potentially damaging, such as:

(a) storage of hazardous materials;
(b) transport of hazardous materials;
(c) dumping of liquid and solid waste;
(d) the discharge of persistent pollutants;
(e) the use of radio-active materials.

(ii) Formulate and co-ordinate at the most appropriate scale (national/Emirate/project) a number of contingency plans for:

(a) oil spills;
(b) explosion, gas release, etc. in major development complexes such as Ruwais and Jebel Ali;
(c) fire in major industrial complexes, including jetties and in urban areas.

(iii) Establish certain standards relating to environmental quality (air, water, food, health etc.) and identify environmentally sensitive areas in the U.A.E where strict pollution control policies should operate (coastal, water sources, etc.).

(iv) Act as co-ordinator in assembling, codifying and disseminating all existing studies which have been undertaken on aspects of E.I.A in the U.A.E.

(v) Develop library facilities on procedures and methods of E.I.A. (and related matters) and disseminate this information to all interested parties.

(vi) Evaluate resources available in the U.A.E. (Government, Universities, private developers) including laboratories and technical facilities which could be used to develop work on E.I.A. and consider how these could be improved.

(vii) Establish an environmental data bank. This would be used by the H.E.C. in carrying out their activities and would also be made accessible to all interested parties.

Within ADNOC itself, it is recommended that the following activities will work towards effective pollution control:

(i) Formulate broad environmental policies within ADNOC in the interest of the Company and as an example to the U.A.E.

(ii) Co-ordinate the enviromental policies of those companies in which ADNOC has an interest so as to introduce more integrated environmental policies.

(iii) Establish laboratory facilities to allow baseline studies, monitoring and other environmental assessment to be undertaken.

(iv) Evaluate all major proposals for which ADNOC is directly responsible or associated, to ensure that environmental considerations are taken into account at the project design stage and that environmental standards are maintained during construction and operation of the plant.

(v) For those development sites where ADNOC is located, or where associated companies are located i.e. Ruwais, to act as co-ordinator in formulating policies for the environment. This might include development of codes of practice and contingency plans for fire, safety, risk and hazard, pollution (air, water, noise) and social impacts.

(vi) Assist the H.E.C. and its technical branch in the development of E.I.A. and sound environmental policies for the U.A.E.

(vii) Codify all environmental studies undertaken by ADNOC and associated companies so as to avoid duplication of effort. Make this information available to all interested parties and where necessary produce, or commission environmental studies on topics for which information is required.

It is suggested that policies must be formulated to introduce E.I.A and pollution control in the U.A.E. These policies would apply to industrial complexes such as Ruwais and to new major developments being planned. There will be a need to formulate a long term policy for the environment but until this is developed certain interim measures will be required.

Specifically it is recommended that policies for certain pollutants should be formulated (page 43). It is also recommended that pollution control effluent standards and environmental quality objectives should be introduced. In time these can be developed within the Emirates but in the short term it is suggested that appropriate standards from other countries could be adopted (page 44). A structured E.I.A. system should be developed in the Emirates but whilst this is being formulated it is recommended that for polluting complexes such as Ruwais, a code of practice for undertaking E.I.A. be introduced (page 45).

INTRODUCTION

Background to the mission and broad objectives

In keeping with its overall strategy of maintaining and enhancing environmental quality, the Abu Dhabi National Oil Company (ADNOC), through the Higher Environmental Committee (H.E.C) of the United Arab Emirates, invited the United Nations Environment Programme (UNEP) to assist in undertaking a comprehensive environmental impact assessment (E.I.A) of the Ruwais Industrial Complex and the Zirku Island Oil Complex. (For convenience these will be referred to as Ruwais and Zirku in the report.)

As requested by ADNOC the general terms of reference for the assessment of the two complexes can be summarized as follows:

(i) Conduct a scientific evaluation of assessment of the present state of the environment of Zirku and Ruwais, before the two sites become fully operational. This assessment would serve as a pre-audit or baseline assessment for future reference after the sites have operated for some time.

(ii) Obtain expert advice on appropriate control measures for reducing or eliminating detrimental environmental effects of the present and planned industrial developments and their related socio-economic activities.

(iii) Obtain advice on establishing the means for long term monitoring of the state of the environment of the two sites and for establishing a feed back mechanism which would aid in initiating remedial action to control environmental degradation.

An additional consideration in requesting the assessment exercise was that both Ruwais and Zirku share numerous similarities with other major large scale industrial complexes around the Gulf and could serve as case studies for environmental monitoring and enhancement within the framework of the Kuwait Action Plan (KAP).

In response to the request, and after discussion amongst the various parties concerned, it was agreed that the impact assessment should be conducted in two phases. The first phase was to be a joint UNEP/IMO mission with three consultants who would:

(i) Review all available documentation concerning the plant lay-out and processes proposed for Ruwais and Zirku.

(ii) Make a preliminary on-site study of Ruwais and Zirku.

(iii) Visit institutions, government departments, and laboratories that might become involved in the environmental impact assessment or its follow-up.

On the basis of this preliminary survey it was agreed that the team would make detailed recommendations for conducting a full scale environmental impact assessment, i.e. the second phase of the study.

Their recommendations would include proposals of impact assessment, baseline studies and manpower requirements as well as suggestions on how institutions in the U.A.E could become involved immediately or in the future. In addition to proposals for implementing initial environmental impact assessment and baseline studies for Ruwais and Zirku Island, it was understood that the team would also suggest how environmental impact assessment might be structured in the U.A.E as a whole and make recommendations concerning its implementation on a national scale.

Composition of the Consulting Team

The team for the first phase was:

(1) B.D. Clark (nominated by UNEP)
Project Director PADC Environmental Impact Assessment and Planning Unit, Aberdeen University, Aberdeen, Scotland

Environmental and land-use planner, specializing in E.I.A. methods and procedures for the assessment of projects and policies.

(2) P.A. Driver (nominated by IMO)
Senior Environmental Consultant
Atkins Research and Development, Woodcote Grove, Epsom, Surrey, U.K.

Marine ecologist specializing in seawater quality studies, marine fisheries and environmental impact assessment.

(3) D.L.Elder
Programme Officer
UNEP Regional Seas Programme Activity Centre
Palais des Nations
Geneva, Switzerland.

Chemist specializing in marine pollution assessment and monitoring techniques.

Scope of the Mission

The team carried out the preliminary survey during the period 29 March - 5 April 1981. A detailed schedule of the mission including alterations mentioned below and the companies and individuals visited is attached as Annex 1 to this report.

During the initial briefing meeting with representatives of ADNOC and the Higher Environmental Committee, several changes in the previously agreed programme were suggested and adopted.

First, the team was asked to visit the industrial complexes at Um El Nar and Jebel Ali and also Dubai Municipality. The consultants were asked to include observations and recommendations concerning environmental impact assessment and monitoring in these additional locations in their preliminary survey.

Secondly, it was recommended that instead of visiting institutions and laboratories to determine their capacity to contribute to E.I.A either at the present time or in the future, the consultants would base their recommendations on the report of a UNEP/Kuwait Action Plan sponsored survey carried out in 1981 by Dr. S. W. Fowler.

The members of the consulting team would like to express their gratitude to the authorities of the United Arab Emirates, the Higher Environmental Committee and officials and representatives of the Abu Dhabi National Oil Company for their co-operation and assistance.

SCOPE AND DEFINITION OF ENVIRONMENTAL IMPACT ASSESSMENT (E.I.A)

The major objective of the mission was to suggest how E.I.A could be undertaken at Ruwais and Zirku and make recommendations as to its possible implementation in the U.A.E as a whole. Before discussing the two case studies it may be helpful to define E.I.A and consider its objective and

Environmental Impact Assessement (E.I.A)

In both developed and developing countries the concept of E.I.A. is growing in importance. There is an increasing realization that initiation of major developments are often based almost exclusively on technical and economic criteria and that environmental factors are not taken into account in the decision-making process. This has led to major problems including disasters (Seveso, Minimatar, Bantry Bay), disruption to ecosystems (Aswan Dam, Amazon Forest), and air, water and other forms of pollution which can severely damage the environment and affect the health of the population. It is also being realized that to install control equipment if pollution occurs may be more expensive than considering how pollution could be minimized at the design stage of the project. In sum an "ounce of prevention is worth more than a pound of cure".

The concept of E.I.A. has been introduced because of the growing awareness of the potential environmental problems associated with a legitimate desire to stimulate economic growth. It has led many countries, with the backing of international organizations such as WHO, UNEP, IUCN and the World Bank to develop legal or informal administrative procedures which require that all major development proposals including policies, programmes and plans, but particularly major projects, are subjected to a systematic evaluation of the likely environmental consequences of allowing a development to proceed. This has led to the development of E.I.A. procedures and methods and the production of documents known as Environmental Impact Statements (E.I.S.). These contain details of the proposed alternatives which have been considered, their likely impact on the local environment and how significant these effects will be, and the opinions of government officials, scientific experts and the affected public about the proposal.

In summary, E.I.A. attempts to:

(i) identify the likely environmental effects, including benefits and disbenefits of a proposed action;

(ii) assess in as scientific and objective a manner as possible the significance of impacts from an environmental, social, health, economic and technical point of view;

(iii) consider whether alternative sites or processes could achieve the same desired economic results, but with reduced environmental effect;

(iv) monitor the development to check that it has as little detrimental effect on the human and physical environment as possible.

E.I.A. therefore could be used to (a) assess proposed new developments (Delma Island), (b) assess extensions to industrial complexes (Ruwais, Jebel Ali) or (c) control pollution of existing projects (Um El Nar). In all these examples, the concept of baseline studies and monitoring could play a key role.

It must be stressed that E.I.A. encompasses more than pollution control and environmental quality standards, risk and hazard analysis, environmental health or environmental management. Whilst each of these are important in their own right, and will continue to remain so, they can play a key role in an overall E.I.A. system.

In most countries E.I.A. has been applied initially to an assessment of projects. In some countries E.I.A. has been developed as part of health legislation whilst in other countries land-use planning, or licensing and authorization procedures have been the mechanism by which E.I.A. is implemented. There is however, now a strong movement in many countries to apply E.I.A. to policies and plans in order to develop an integrated E.I.A. system. The example of the U.A.E could be taken to illustrate how such a system would operate.

At the federal scale broad environmental policies and strategies could be defined. These could relate to environmental quality standards for various types of pollutants, policies for the transport and dumping of liquid, solid or toxic wastes and policies for protecting the marine environment against the threat of an oil spill. Under "Institutional Arrangements to implement E.I.A. in the U.A.E" it is suggested that the Higher Environment Committee (H.E.C.) could play a key role in formulating these national environmental policies. They could also ensure that as policies on major investment and development are formulated they are evaluated as to their likely environmental effects. If national standards and environmental criteria exist, it is a far easier task to assess the likely consequences of an individual development, whether this be a new project or an extension to an existing industrial complex. Even if there is no national policy for the environment it is suggested that the potential environmental effects of a proposal should be assessed. It is likely therefore in the U.A.E. that although there may be benefits in having a fully integrated E.I.A. system that covers policies, plans and projects, the greatest opportunities to implement E.I.A. initially will be at the project level.

Baseline studies

Baseline studies are integral features of any E.I.A. system. Essentially they are concerned with trying to measure existing environmental conditions. They may be required to be undertaken at a number of different levels. At the federal level they will be necessary if any attempt is made by the Government to impose effluent standards or environmental quality standards. If for example, the U.A.E. were to propose the use of emission standards for control of gas discharges to the atmosphere, it would be necessary to establish the existing air quality in order to impose realistic standards. At the scale of assessing an individual project, baseline studies are required for two main purposes. First they have to be undertaken to assess how a development proposal is likely to impact upon the local environment. In this case they can be thought of an aid to rational decision making. Second, they are required so that monitoring the effects of a project can take place once it becomes operational. Without knowledge of the existing situation i.e. baseline data, it is impossible to scientifically assess the effect of the development on the environment once it becomes operational.

At the project level the form the baseline studies can take will largely be conditioned by the nature, and indeed, knowledge, of the local environment and the characteristics of the proposed development. Sections on "Baseline assessment" and "Baseline studies" indicate the type of baseline studies that could be undertaken for major developments. It should be noted, however, that many baseline studies which have been undertaken have neither been sufficiently comprehensive in coverage to allow an adequate picture to be established nor have they covered a sufficient time period to allow for seasonal variations to be assessed. Whether one looks at marine or terrestrial systems, at least one year is required to take account of seasonal variations. Whilst in some instances this may not be necessary, it is important to stress that the baseline should be thought of as a dynamic data base which allows an evolving description of the environment to be presented to all interested parties, but in particular the developer and government agencies concerned with environmental quality.

Monitoring

The role of monitoring in E.I.A. is essentially concerned with relating baseline studies to changes which may have been brought about as result of the development. Another function of monitoring is to test whether the technical specifications of the equipment are correct. In short, monitoring should ensure that adverse impacts are detected at an early stage so that, where possible, remedial actions can be taken before changes become irreversible.

Once the development exists, monitoring should become a routine procedure. Monitoring can take the form of spot-checks or fully integrated, continuous schemes. Normally the E.I.A will have identified those aspects of development which will require to be monitored. If possible, stations for those parameters which should be monitored ought to be established before site work commences so that the pre-development situation is known. (This links to the baseline studies which may indicate optimum on-site and off-site locations for setting up monitoring equipment). Background monitoring at unaffected control stations should be established so that random fluctuations are not mistakenly ascribed to the development. The information output from monitoring can be directed both backward and forward in time. Thus in some circumstances it is possible to assess retrospectively, what changes have been brought about by past developments; and forward, to adopt measures for assessing the changes which current developments may bring about.

It is necessary to formulate E.I.A., baseline studies and monitoring which are appropriate to the specific sites which are under consideration. Therefore, as previously mentioned in the introduction, the study team reviewed all the available documentation concerning Ruwais and Zirku, and made visits to the two sites. The following two sections summarise the information that was gained, including some initial observations on environmental problems that were apparent or might be expected in the future. Given that far less time was spent on Zirku than Ruwais (both on site-inspection and on literature review), comments on Zirku are necessarily less detailed than those for Ruwais.

RUWAIS INDUSTRIAL AREA

Physical setting

The Ruwais Industrial Complex is situated on the southern coast of the Gulf, some 235 kms West of Abu Dhabi City and just a few kilometres East of the existing Abu Dhabi Company for Onshore Oil Operations (ADCO) crude oil loading and export terminal at Jebel Dhanna. The site was chosen because of its reasonable proximity to the onshore oil and gas fields and also to relatively deep and sheltered waters.

The industrial complex is being constructed on a plot of "sabka" sand fronting directly onto the shore. A coral reef runs parallel to and approximately 1 km distant from the shore, and the deep water (10 m) required for loading tankers is approximately 3 kms from the shore. An associated housing complex is being constructed on the North slope of the plateau which arises 6 kms South-west of the industrial complex.

Ruwais benefits from a relatively high prevailing windflow from the North-west to North sector, reflecting the regional persistence of the "shamal". Land and sea breezes circulating are also evident throughout the year. The month with the greatest frequency of calms is July and, as can be seen from Tables 1 and 2, even in this month wind speed only falls below 4 knots during 6.8 percent of the time. This all augurs well for the dispersion of air pollutants. However, temperature inversions characteristic of desert climates would adversely affect the dispersion of air pollutants. The frequency and persistence of inversions in the U.A.E. in general has been reported by Economopoulos* as follows:

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* Economopoulos, A.P. Draft report on assesment of land-based sources of industrial pollution in the U.A.E. UNEP, September 1980.

Table 1

Diurnal wind variation daytime July 1977 (Ruwais)

WINDSPEED INTERVAL (KNOTS)	PERCENTAGE OCCURRENCE AND WIND DIRECTION CLASS INTERVAL												
	345 015	015 045	045 075	075 105	105 135	135 165	165 195	195 225	225 255	255 285	285 315	315 345	TOTAL
<1	0.3												0.3
*1-4	1.1	1.1		0.8	0.5		0.3	0.3	0.5	0.3	0.3	1.1	6.3
4-7	4.8	0.8	1.8	0.5	0.3			1.9	1.6	1.6	2.7	5.6	21.6
7-11	8.2	3.2	0.8				0.3	0.8	2.1	2.4	11.5	5.6	34.9
11-17	5.6	1.1	0.8				0.3	0.5	1.6	2.1	8.2	10.4	30.6
17-22											1.9	2.7	4.6
22-28												1.6	1.6
TOTAL	20.0	6.2	3.4	1.3	0.8	0	0.9	3.5	3.8	6.4	24.6	27.0	99.9

*It is standard meteorological practice to record speeds less than the instrument's threshold level

Table 2

Diurnal wind variation night-time July 2977 (Ruwais)

WINDSPEED INTERVAL (KNOTS)	PERCENTAGE OCCURRENCE AND WIND DIRECTION CLASS INTERVAL												
	345 015	015 045	045 075	075 105	105 135	135 165	165 195	195 225	225 255	255 285	285 315	315 345	TOT
<1		0.2	0.2		0.5	0.2		0.2	0.2	0.2	1.1		2.8
1-4	2.7	2.2	2.2	0.8	1.9	0.8	0.5	2.7	2.7	1.3	1.1	2.2	19.1
4-7	4.3	3.0	1.1	1.3	1.1	0.5	3.8	3.5	6.2	1.3	3.5	3.8	33.4
7-11	1.6	1.6	0.8	0.5	1.1	1.3	3.5	4.8	2.7	1.9	3.8	3.2	26.8
11-17	1.6	0.2	0.2				0.2	1.1	0.2	0.5	2.7	4.3	11.0
17-22											2.4	1.6	4.0
22-28												0.2	0.2
TOTAL	10.2	7.2	4.5	2.6	4.6	2.8	8.0	12.3	12.0	5.2	14.6	15.3	97.3

Percentage frequency of low-level temperature inversions

January	37%
February	25%
March	35%
April	42%
May	44%
June	47%
July	56%
August	57%
September	58%
October	47%
November	45%
December	43%

Persistence of low-level temperature inversions

less than three hours	42%
three to six hours	37%
six to nine hours	13%
nine to twelve hours	5%
twelve to fifteen hours	2%
fifteen to twenty-four hours	1%

The marine environment is characterised by very high salinities (approximately $44^{o}/oo$), high summer water temperatures (max. 35.5°C) and relatively low tidal amplitude (mean 1.06m). Tides are almost totally diurnal.

Currents at Ruwais are variable and extremely responsive to wind. However, local information suggests that there is a residual current running from West to East across the Ruwais waterfront.

Meteorogical and oceanographic information on Ruwais and the surrounding area are contained in the following reports:

Danish Hydraulic Institute, Ruwais Industrial Complex. Final reconnaissance in connection with sedimentation. December 1979.

Dames and Moore, Report, Jebel Dhanna Industrial Development Plan, for Abu Dhabi National Oil Company, Preliminary Meteorological Appraisal. December 1975.

Dames and Moore, Report, Flooding Investigation for Ruwais Industrial Development, Abu Dhabi National Oil company, August 1977.

Dames and Moore, Ruwais Metocean Study, August 1979.

Decca Survey Ltd., Ruwais Loading Jetty Hydrographic Survey, July to October 1973. Prepared for Bechtel International Ltd. 1973.

Delft Hydraulics Laboratory. Cooling water intak~. Sedimentation and recirculation. R 1326, December 1977.

Delft Hydraulics Laboratory. Recirculation study for Ruwais refinery project. R 1514, December 1979.

Fichtner. Ruwais utilities project seawater circulation system. Final design report. October 1979.

IMCOS Marine Ltd., Metocean Study/Survey Ruwais 1973, Ref. 73/92, Report prepared for Dames and Moore. 1973.

IMCOS Marine Ltd., Meteorological and Oceanographic Study Southern Arabian Gulf, Ref. 68/52, Report prepared for Abu Dhabi Petroleum Company Ltd., 1969.

IMCOS Marine Ltd., Wind Data Jebel Dhanna 1962-72, ref. 72/77.

IMCOS Marine Ltd., Ghasha Tower (T.2), Jebel Dhanna Meteorological and Oceanographic Survey 1963-64, Ref. 63/1, Report prepared for the Abu Dhabi Petroleum Company Ltd., 1964.

IMCOS Marine Ltd., Current Survey Yas Island 1973, Ref. 73/01, Report prepared for Dames and Moore, 1973.

The information contained in the long list of publications above should not be taken to be comprehensive. Much of it is specific to a certain time of the year or an individual project. In particular, more information is needed on seawater currents and air temperature inversions. No information is available on sea water quality or air quality.

Industries and their siting

The initial objective of the industrial development of Ruwais is to maximize the economic utilization and added-value of the hydrocarbon resources of Abu Dhabi. To this end, the proposed projects making up the complex are primarily based on the use of natural gas, gas liquids and crude oil as feedstock and fuel. Onshore oil and gas fields, which are operated by the Abu Dhabi Company for Onshore Oil Operations (ADCO), are the main source of the hydrocarbons. At Ruwais, the incoming feedstocks (which were previously wasted, primarily by burning them off in the desert) will be upgraded into marketable products. This will be done by removing condensates and producing natural gas liquids, fertilizers and other products.

Already existing at the time other projects were identified and planned, was the ADCO crude oil loading and export terminal at Jebel Dhanna just a few kilometres West of Ruwais. The capacity of this terminal is 1,280,000 barrels per day. Approximately forty oil tankers call at the terminal each month to deliver Abu Dhabi crude oil to various places around the world.

Plants and facilities at Ruwais nearing completion at the time of the mission were a 120,000 barrels per day refinery, a separation plant (NGL plant) designed to produce butane, propane and condensates, the infrastructure to support the industrial plants, and the first phase of the housing complex with 1,000 housing units. The NGL plant was being commissioned during the UNEP/IMO mission visit to the site. The construction harbour, the NGL loading jetty and refinery product loading jetty with associated cabotage had already been completed. In the desert outside Ruwais, ADNOC in a joint venture with CFP, Shell and Partex is constructing extraction plants in the oil fields of Bu Hasa, Asab and Bab. These plants extract, from the associated gas produced with the oil, the liquids and LPG which are transported to the Ruwais separation plant by a network of pipe-lines.

In parallel, ADNOC is constructing a second network of natural gas pipe-lines which will transfer the natural gas from the oil fields to Abu Dhabi and to Ruwais where it will be used as fuel oil and feedstock for the industrial plants.

Projects and facilities now under planning and engineering include a Fertilizer Plant to produce 1,000 MTPD Ammonia and 1,500 MTPD Urea, a 90 megawatt power and utilities Plant, a twin berth Bulk Cargo Terminal, the second phase of the housing complex with an additional 1,000 housing units and support facilities, and a light industrial park to serve the outside maintenance needs of all projects. The ground was being cleared for construction of the ammonia/urea plant during the mission visit to Ruwais.

In conceptual planning is a 120,000 B.P.D expansion to the refinery with conversion units to maximize diesel and gasoline production, as well as extension to the Fertilizer Plant after 1986.

In the longer term, other projects are envisaged such as a liquefied natural gas (LNG) plant, a petrochemical complex and an iron and steel plant. The whole complex will take 10 to 12 years to complete.

The relative positions of existing and future plants within the complex are shown on the site plan (Figure 1).

Initial observations and potential environmental problems

Planning, organisation and administration

The method of planning, organisation and administration of the Ruwais development has not been conducive to the preservation of environmental quality.

The Master Plan for the Ruwais Industrial Project (Arthur D. Little/Dames & Moore November 1976) makes no mention of environmental considerations saved for the following simple liquid effluent standard to be applied to each industrial project:

ph	6.5 - 8.5
Temperature	45°C
Biological Oxygen Demand (BOD)	50 ppm
Chemical Oxygen Demand (COD)	200 ppm
Oil	15 ppm
Sulphide	0.4 ppm
Mercaptans	Nil
Phenols	0.5 ppm
Ammonia	25 ppm
Suspended Solids	40 ppm

Such a standard has, in any case, only limited value since it takes account of neither the assimilative capacity of the environment, the synergistic and additive effects of several effluents being discharged at one site, nor the special environmental importance of certain other specific toxic compounds which might also be discharged.

Once each project has been approved it is then designed and constructed in isolation from the other projects in the complex (apart from consideration of the common utilities and feedstock transfer). The result of this lack of co-ordination has been the commissioning of a number of unconnected studies designed to answer specific problems. This has many potential consequences for both environment and safety. For example, several separate studies have been conducted in isolation concerning the various water intakes at Ruwais. The Delft Laboratory was commissioned to undertake a "Recirculation Study for the Ruwais Refinery Project". The final paragraph of their report (December 1979) sums up the nature of the problem. Having determined that recirculation of effluent should not be a problem, the report adds: "We do not know the complete Master Plan for the development of Ruwais. However, it is strongly recommended to study the future effects of construction of groynes, harbours and future cooling water discharges from other industries within the area". The study of potential sedimentation at the ammonia-urea/utilities

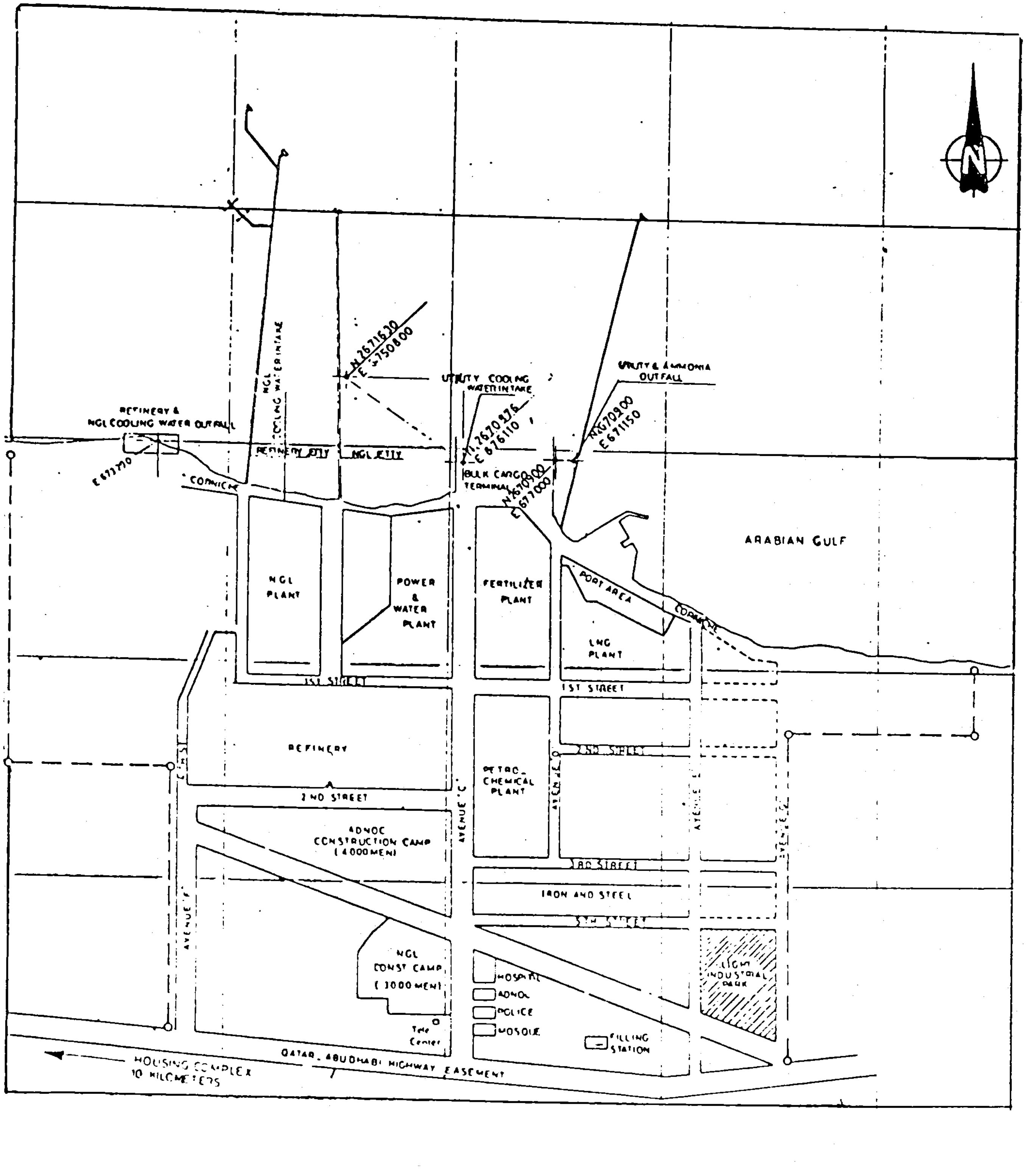


Figure 1: Plants within the complex on the site plan

sea water intakes (Danish Hydraulic Institute - 5.12.79) was similarly commissioned and conducted without reference to the likely sedimentary effects of other marine structures to be built in the vicinity. Again, two jetties have been constructed at Ruwais (for the refinery and the gas plant). However, the separate evolution of the two design projects has resulted in a pair of jetties whose relative positions do not appear to be optimal from the navigational and safety point of view. The pros and cons of having two separate jetties do not appear to have been discussed.

A degree of co-ordination between the projects has recently been attempted internally to obtain data on pollution aspects of the projects. However, separate development has proceeded so far that present attempts at co-ordination have met with some difficulty. As the development of Ruwais continues, the environmental and operational problems raised by inadequate co-ordination will grow.

Other aspects of planning will be referred to in Section "Air and Water Pollution" below.

Ecology

Any polluting activity at Ruwais will have an effect on the ecology of the area. However, some activities will have a particularly dramatic effect on the surrounding flora and fauna.

First, the construction site is being excavated. Whilst the salty "sabka" desert would appear to be relatively uninteresting from an ecological point of view, the site clearance will have totally destroyed the terrestrial habitat without the ecological (or archaeological) importance of the area having been established.

Secondly, various marine works are underway. These involve dredging, piling, reclamation and general construction. Again, little is known of the existing marine ecology. However, it is known from the Hazelton Report (Marine Environmental Studies at Jebel Dhanna, 1979) that the new industrial complex is one of the few sites between Jebel Dhanna and Ruwais where living finger coral Porites and stag horn coral Acropora can be found on the reef. These will be adversely affected by the sediments put into suspension by the marine works. The loss of corals can upset the reef ecosystems, including reef fisheries, which are dependent upon them.

The Hazelton Report also draws attention to the area of marine wetland between Jebel Dhanna and Ruwais. Hazelton points out that such areas are usually of ecological importance, e.g. as nursery grounds for fish and shrimp. Whilst the exact importance of this area has not been determined, the works going on at Ruwais are likely to affect the sediment balance in the area.

Thirdly, once development at the Ruwais site is complete, large quantities of seawater will be used for cooling and other purposes. The utilities and ammonia/urea plant will use 85,000 m^3/hr initially, increasing to 250,000 m^3/hr in the future, and the NGL plant will require 30,000 m^3 / hr, rising to 45,000 m^3/hr. The combination of the 9°C temperature rise, the increase in salinity and chlorine residual in the effluent water will kill most of the entrained plankton which will include the larvae of economically important fish and shellfish. The fact that many organisms in the area are living close to their tolerance limits for temperature and salinity means that the outfall water is also likely to have a significant effect on local benthic communities.

Finally, in total, the industries to be developed at Ruwais will introduce into the marine environment a large quantity of organic compounds which will have a fertilizing effect on the ecosystem. This can have undesirable effects such as increased seaweed growth and the initiation of blooms of toxic algae. The scale of the problem cannot be determined without a proper investigation of both the quantities of the pollutants and the dynamics of the receiving environment.

Other ecological effects are discussed in the pollution sections below.

Air and water pollution

Liquid, gaseous and solid wastes will arise from a wide range of processes at Ruwais. As an example, Figure 2 indicates the materials that may be lost to the environment from an oil refinery (the Ruwais refinery will not initially carry out all of the processes shown in Figure 2).

Data on expected pollutants are as yet only available from the refinery and ammonia/urea projects, and those data are minimal.

The refinery has a design criterion for water pollutants (including treated ballast) which broadly follows that suggested in the Master Plan, but with reduction in BOD (30 ppm), COD (120 ppm) and suspended solids (30 ppm).

This is again an individual effluent standard which has limited value as explained above. The concentration of water pollutants to be discharged from the ammonia/urea plant exceeds those in the Master Plan effluent standard, but it is estimated that the levels of pollutants will conform to this standard after dilution in the cooling water outfall. The standard itself is therefore being interpreted in two different ways.

The ammonia/urea plant has a design criterion for air pollutants. However, this criterion is expressed as ground level concentrations (g.l.c.) of NH_3, NH_2, SO_2, H_2S, CO and urea dust. Since the contribution of the same air pollutants from other industries up-wind of the ammonia/urea plant (NGL plant, refinery, power/desalination plant) has not been estimated, and since the stability of the air at Ruwais had not been properly investigated, it is not possible to design the plant to meet any criteria. It is worth mentioning here that the g.l.c. adopted for continuous discharges of ammonia vapour (1 ppm) is unusually high. No information was available on estimated air pollution during normal shutdown conditions (i.e. for maintenance or repairs) or emergency shutdown during which greater concentrations of ammonia can be expected to be purged into the atmosphere. Similarly, operational failure of the urea drilling tower could increase urea dust emissions by 100-fold.

It is unfortunate, that the NGL flare area has been situated on the westernmost upwind margin of the site. This means that unless very tall stacks are used, the ground level concentrations of air pollutants are likely to be at their maximum within the Ruwais complex. (The NGL flares will be used to flare-off excess gases and to flare-off H_2S until this can be diverted to the refinery desulphurization plant).

Future pollutant arisings and the possible combination of pollutants once released to the environment do not appear to have been considered in the development of the Ruwais site. Of particular concern are the toxic compounds which can accumulate in fish and shellfish. The discharge of large volumes of chlorinated seawater along with phenolic compounds and other organics could lead to the formation of toxic polychlorinated organics. Low concentrations of phenols can, in any case, reduce the market value of fish e.g. 0.0015 ppm of chlorophenol can cause the tainting of fish flesh. The planned iron/steel and petrochemical industries are likely to discharge toxic, heavy metals, particularly if a mercury-cell, chlor-alkali plant is built to supply chlorine for PVC manufacture. Metals will also enter the sea by leaching and corrosion of plant pipework and by the use of metallic corrosion inhibitors.

The marine ecosystem is complex, and whilst it is possible to estimate the fate of organic pollutants, the persistent or conservative pollutants mentioned above present more of a problem. As soon as a pollutant is added to a marine habitat, it becomes part of the environment of its resident biota. Under favourable conditions, the pollutant is diluted, dispersed and transported by turbulent mixing, current, and migrating organisms. Frequently, however, marine water is not mixed thoroughly and a high concentration of pollutants may exist in local areas. In addition,

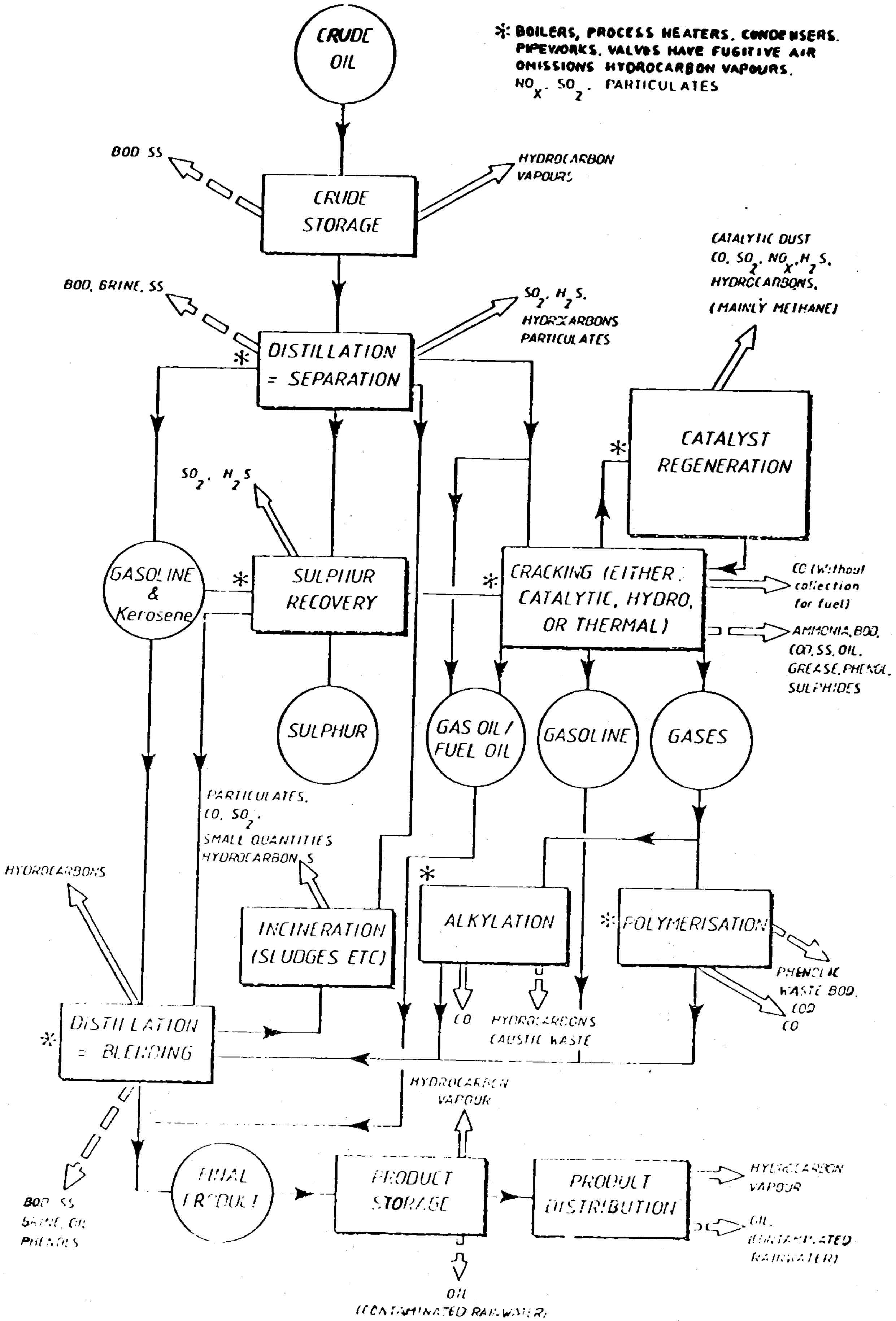


Figure 2: Flow diagram for the pretroleum refining industry

there are biological, chemical and physical processes taking place that concentrate pollutants and lead the pollution back to man (Figure 3). The integrated effects of all these processes can only be determined by a proper study of both the nature of the pollutant and the environment into which it is to be discharged.

The effects of chronic hydrocarbon pollution of the sea should not be ignored at Ruwais. Whilst all water discharged (including deballast water) is to be treated to 15 ppm oil, the locality will also be influenced by untreated deballast water from the Jebel Dhanna terminal upstream of Ruwais.

At Ruwais, as at other sites visited during the mission, the desalination plant will be developed side by side with polluting industrial development. The lack of detailed consideration of water pollution along with the relatively uncoordinated development of industries therefore has public health implications not only for food fish, but also for drinking water supplies. The outfalls from both the refinery and the NGL plant at Ruwais are situated upstream of the utilities intake.

Solid wastes

The solid waste arisings at Ruwais are already creating an impact on visual amenity. If the uncontrolled dumping of solid waste continues in the desert this impact will develop into a hazard. It is known that the Bedouin salvage some of the materials dumped. Very shortly more hazardous wastes will arise at the Ruwais Complex and if these are simply dumped according to usual practice, people will be injured.

The disposal of solid waste at Ruwais can only be controlled and managed if a special site is set aside for dumping, secured with fencing and controlled by a permanent control officer. This site would need to be managed along up-to-date lines. Examples of required practices are as follows:

- Wastes to be covered each day
- Pests to be controlled
- Separate areas to be set aside for hazardous waste
- Incoming wastes to be logged
- Fire to be prevented
- Hazardous (e.g. asbestos) and toxic (e.g. lead-containing) wastes to be packed in containers
- Incompatible wastes to be separated

Oily and other sludges will also need to be disposed of. If these are simply dumped in a sand-pit as at the Um El Nar refinery, pollution and hazards are likely to result. Depending upon the nature of the waste disposal site chosen, there may, therefore, also be the need to an incinerator to deal with oily wastes and sludges. Certainly, there is a need for such a facility generally within the U.A.E., as there is also the need for a proper controlled toxic waste disposal site for difficult wastes which cannot be permitted to be incinerated. Economopoulous (op. cit.) has already drawn attention to the quantities of oily and toxic sludges arising in the U.A.E., and identifies this as the most important industrial solid waste problem in the country.

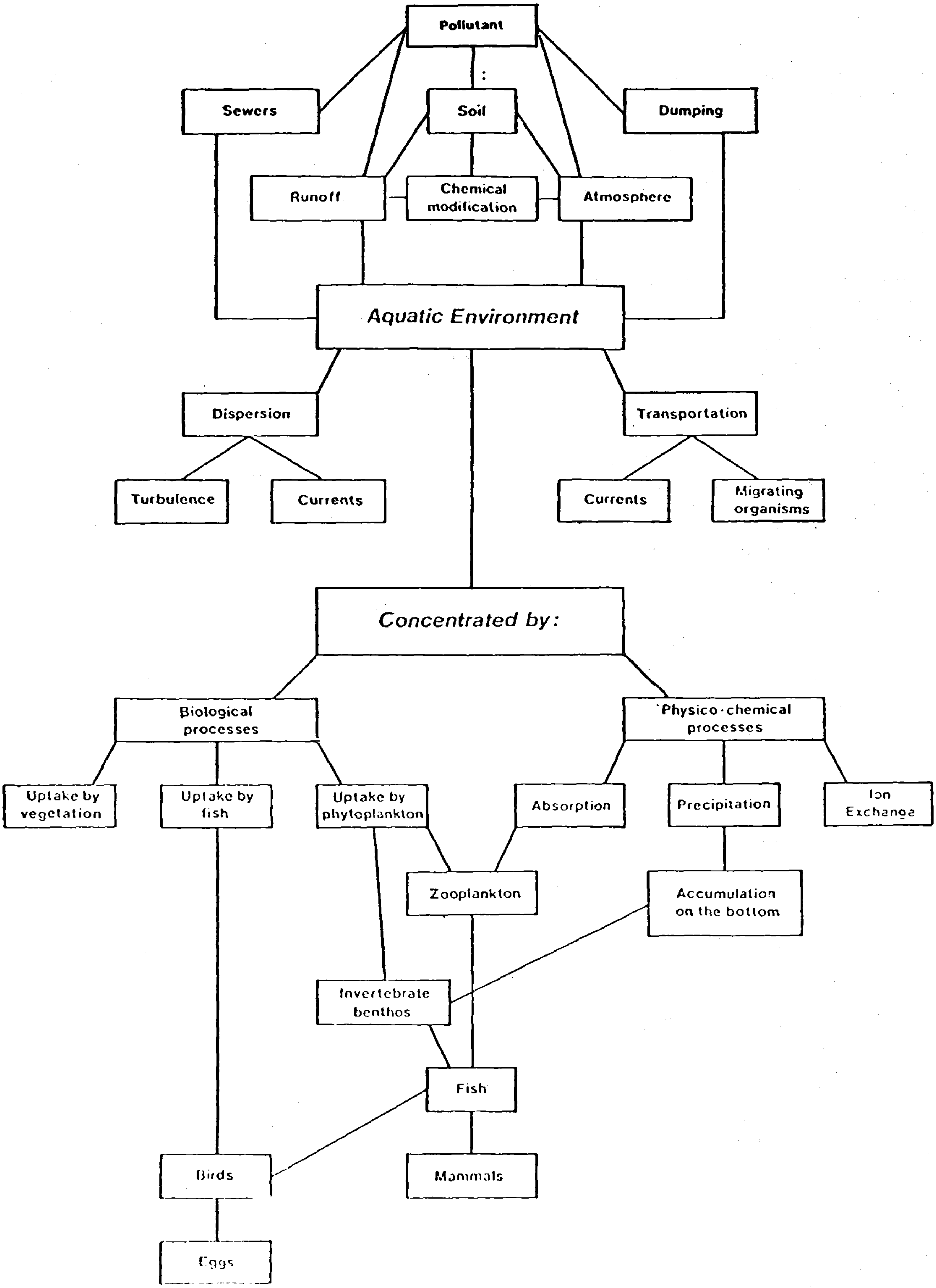


Figure 3: Various processes that determine the fate and distribution of pollutants in the marine environment

Hazardous materials

The development of Ruwais will necessitate the storage, handling and transport of hazardous materials. The establishment of a sophisticated industrial complex in a remote area of a country which does not have a sophisticated framework of industrial legislation presents immediate problems. For example, the Ruwais road system as well as the Abu Dhabi/Qatar road will eventually be carrying tankers containing dangerous goods such as butane and chlorine. Given the road conditions, the standards of driving, the nature of vehicles and the lack of emergency services, this presents a very real danger.

There is an immediate need for a uniform system for the clear marking of road tankers to indicate their contents and the action to be taken in the event of accident or spillage. The necessary regulations could be adopted piecemeal from the system of coding used in the UK or the Interstate Commerce Commission of the USA. The emergency services will need to be actively involved in development of these regulations.

Regulations also need to be formulated for the construction of such road vehicles. For example, the addition of heavy side and rear fenders to tankers carrying dangerous goods should become mandatory to avoid direct impact with the tanker.

Clearly, the road and traffic system within the U.A.E. is undergoing a rapid process of improvement and sophistication. However, development of safety features, road markings and driver advice has not kept pace with physical development. There is, for example, a pressing need for the construction of crash-barriers along the central reservations of main roads to prevent the disastrous consequences of head-on collisions involving tankers loaded with inflammable or highly toxic materials.

It is anticipated that the new industries at Ruwais will take care of hazardous materials, but the receipt and handling of tetra-ethyl lead at the refinery terminal will require particular care.

Industrial hygiene/safety

As with the handling of hazardous materials, the development of a new industrial complex without strict regulations concerning industrial hygiene and safety could lead to the ill-health or disability of workers. It is anticipated that the industries at Ruwais will be taking a responsible attitude to these matters. It was observed that many companies and projects show concern for individual hygiene and safety. However, if an Industrial Area Authority were formed at Ruwais it would be able to enforce a common standard in these matters (see page 41).

Noise is often considered under the heading of industrial hygiene, and ear-defenders are consequently issued to workers in particulary noisy areas. However, noise should also be considered as an environmental pollutant. Whilst individual projects at Ruwais may have plans for controlling noise, the mission found no evidence of any standard, criteria or environmental quality objectives for noise having been employed at the design stage. Noise levels are another standard which could be set and enforced by an Industrial Area Authority.

On a broader basis, planning for safety at Ruwais does not appear to have been given a high priority. The proximity and relative locations of individual industries suggest that the possibility of disaster at one plant compromising the integrity of another has not been fully taken into account. This raises the need for joint emergency plans and emergency exercises between the various industries on the site.

Sociological aspects

The construction camps and housing complex at Ruwais are planned to provide for all the material and spiritual needs of their inhabitants. However, the social problems of the inhabitants have not been foreseen.

The families in the permanent housing, particularly the first to arrive, will also face social problems. The feeling of isolation, for example, will be evident for some time, particularly for those who have left thriving communities. The social pressures will be particularly great if families are moved into the complex prior to completion of the education, sporting and entertainment facilities.

The social pressures within the construction camp are more obvious, thus:

- Work and heat stress
- Spartan accommodation
- Harsh environment
- Separation from families
- Single sex status
- Isolation from towns
- Mobile existence

(In addition, workers in the construction camps are liable to the direct effects of environmental pollution because of the temporary nature of the accommodation).

ZIRKU ISLAND COMPLEX

Information on the Zirku Island Complex gathered by the mission team was less comprehensive than that collected for Ruwais, the reason being that only one day was available for visiting the island, meeting local staff and collecting data (see Annnex I of misssion schedule).

Physical setting

Zirku is a small pear-shaped island approximately 5 km long and 2.5 km wide at its widest point. It is situated approximately 80 nautical miles NNW of Abu Dhabi City, 55 nautical miles NNE of Ruwais and 20 nautical miles SSE of Das Island. Zirku is an arid and mostly barren island apparently of volcanic origin, which until recently was uninhabited by man. Both the prevailing winds and the residual current which influence the island originate in the North to North-west sector. (The ZADCO SESAM study has taken monthly measurements of sea temperature, winds, waves, currents, air temperature and air pressure at Zirku for the years 1977-80). The shores of the island mostly consist of rock platforms with some coral sand; the southern shores are fringed with coral reefs. Before development began, the island was the haunt of numerous sea birds some of which are still attracted to the area.

Industries and siting

The Zirku Island Complex is being constructed to receive crude oil by undersea pipelines from the Zakum Upper Oilfield to the East side of the island, and to treat the crude prior to shipment via SBM's to be located on the North-west side of the island (see Figure 4). The complex is designed initially to receive 500 mbd of crude oil. The projected build up to this figure is shown below:

Year 1	(probably 1982)	95 mbd
Year 2		145 mbd
Year 3		240 mbd
Year 4		330 mbd
Year 5		415 mbd
Year 6		460 mbd
Year 7		500 mbd

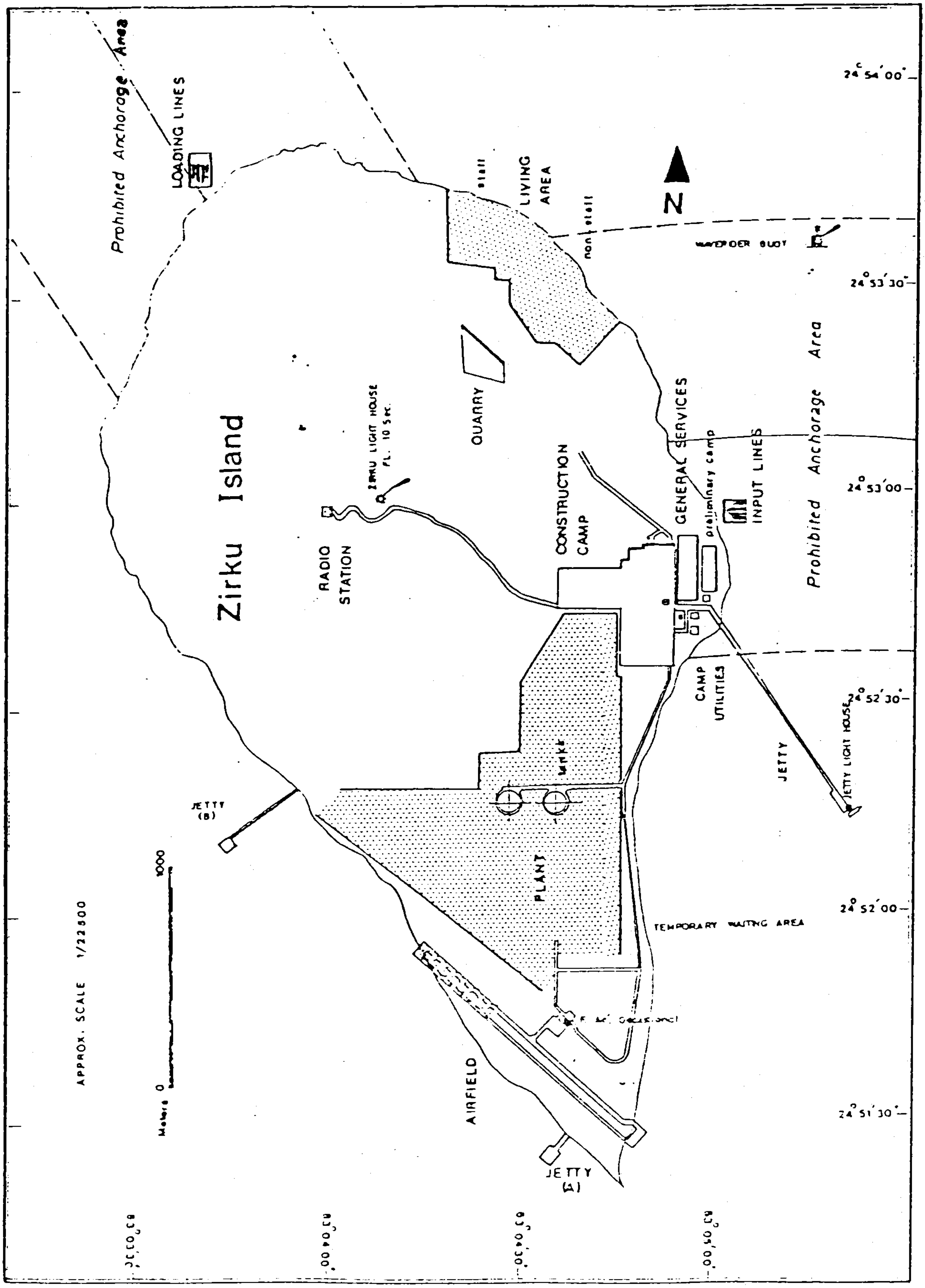

Prohibited Anchorage Area
LOADING LINES
staff
LIVING AREA
non staff
N
Zirku Island
QUARRY
RADIO STATION
ZIRKU LIGHT HOUSE FL. 10 Sec.
CONSTRUCTION CAMP
GENERAL SERVICES
preliminary camp
INPUT LINES
Prohibited Anchorage Area
CAMP UTILITIES
JETTY
JETTY LIGHT HOUSE
tanks
PLANT
JETTY (B)
TEMPORARY WAITING AREA
APPROX. SCALE 1/22500
Meters 0 1000
AIRFIELD
JETTY (A)
24°54'00"
24°53'30"
24°53'00"
24°52'30"
24°52'00"
24°51'30"

Figure 4

There is also the possibility that capacity may eventually exceed 500 mbd (1,000 or 1,300 mbd) and that crude may eventually also be received from SARB.

The type of treatment that the oil will receive at Zirku is indicated in Figure 5. Essentially, the process will remove water, salt and gas from the crude oil.

Initial observations and potential environmental problems

Planning, organization and administration

Whilst the raison d'être at Zirku is the treatment of crude oil, the current construction is, of necessity, effectively creating a new island "state" with its own housing complex, utilities and infrastructure. This situation is similar to that pertaining at Ruwais, except for the fact that Zirku is surrounded 100 percent by sea rather that 50/50 by sea and land. This is a very significant difference from the point of view of the dispersal and effects of environmental pollutants.

The planning of Zirku would appear to have been more logical than at Ruwais, and this probably stems from the fact that Zirku is one single project (being developed by ZADCO). For example, the construction camp and the permanent housing complex have both been located upwind of the plant.

Ecology

Whilst it has been noted that Zirku is an arid and barren island it is nevertheless of ecological (and geological) interest. Large proportions of the island have already been mechanically disturbed to provide either sites or materials for the construction of plant, buildings and roads. However, little is apparently known of the existing terrestrial ecology (or archaeology) of the island. One might expect the presence of flora and fauna adapted to the arid conditions.

As has been mentioned, a small island is a natural habitat for sea birds. Most of these have been driven away by the construction activity. However, those that remain are inevitably attracted by any source of non-saline water. Members of the mission visiting the island noticed numbers of seagulls that were dead or dying due to drinking the effluent from the construction camp septic tank. It is therefore essential that all effluents be piped at least to the low tide level. Large rafts of cormorants were also observed off the western side of the island. These would obviously be at risk from any spillage of oil from the SBMs and their associated undersea and floating hoses.

From the mission's very superficial look at the coast of Zirku, there was evidence that the island would support a rich and varied fauna on its littoral and sublittoral rock ledges, coral reefs and sublittoral sands. During the course of a low spring-tide, large concentrations of the air-breathing shell-less gastropod Onchidium peronii were observed on the shore and swarms of the sea-urchin Echinometra mathaei were seen in the sub-littoral zone. As far as is known, such marine communities have not been studied at Zirku, but they would certainly also be at risk from oil spills.

It is understood that the site now occupied by the airport used to be a beach where turtles annually laid their eggs.

Air and water pollution

Given Zirku's geographical position, air and water pollutants generated by the complex are literally a "drop in the ocean". However this does not mean that they can be ignored.

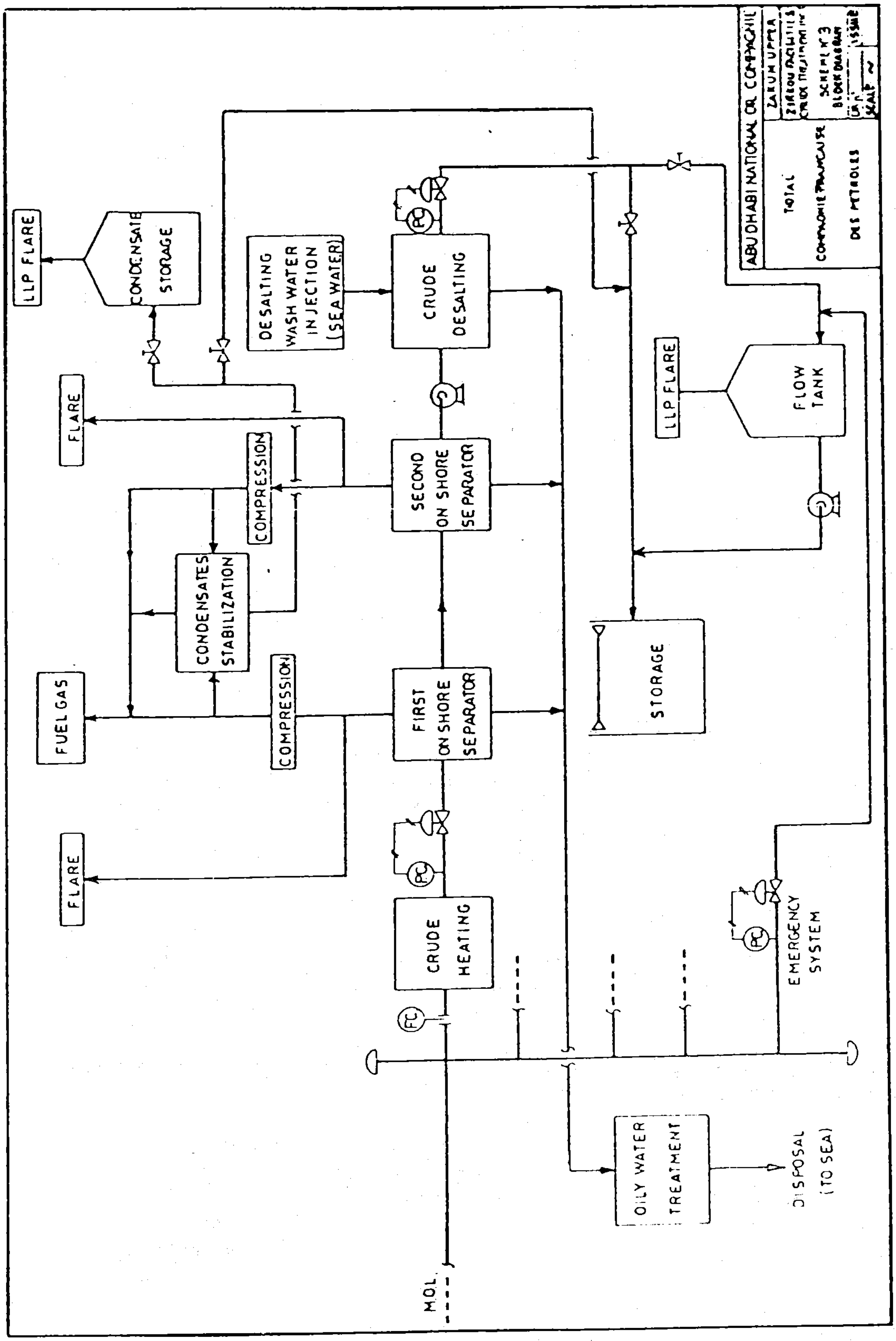

LLP FLARE
CONDENSATE STORAGE
FLARE
FUEL GAS
FLARE
DESALTING WASH WATER INJECTION (SEA WATER)
CRUDE DESALTING
COMPRESSION
CONDENSATES STABILIZATION
COMPRESSION
SECOND ON SHORE SEPARATOR
FIRST ON SHORE SEPARATOR
CRUDE HEATING
PC
PC
FC
STORAGE
LLP FLARE
FLOW TANK
PC
EMERGENCY SYSTEM
OILY WATER TREATMENT
DISPOSAL (TO SEA)
M.O.L.
ABU DHABI NATIONAL OIL COMPANY
TOTAL
COMPAGNIE FRANÇAISE DES PETROLES

Figure 5

4,000 m^3/hr of seawater will be used for cooling in the process. However, the major water pollutant at Zirku is expected to be oil. On the basis of a 500 mbd throughout, the oily water arisings will be as follows:

1.	Process water (formation water from the gas/oil separators and seawater used for washing in the desalters)	300 m^3/hr
2.	Polluted service water and miscellaneous effluents	30 m^3/hr
3.	Contaminated surface water	50 m^3/hr
	Total	330 - 380 m^3/hr

This oily water will be treated to a residual oil content of 35-50 ppm after passage through the API separator. The final effluent will pass through an observation basin of 5000 m^3 capacity (a retention time of 12 hours) before discharge to sea; there will be a sampling device at the outlet. The oil content of the effluent could be reduced by 30 to 60 percent by flocculation in future if necessary. Oil will also enter the sea at Zirku from deballasting of tankers prior to loading.

The fringing reef areas could be expected to be productive areas for fish, and it is known that dhows make irregular visits for commercial fishing. The quantities of oil to be discharged do not appear to be significantly great. However, the likely effects of the oily effluents and their significance to these fish stocks cannot be finally determined until a proper study has been made of the chemistry and ecology of the marine environment at Zirku, and the extent of the fishery there. There does, fortunately, already exist a considerable body of oceanographic data for Zirku from the ZADCO SESAM study.

Zirku is well placed for the dispersion of gases. However, it is not known whether the local terrain and wind speeds have been taken into account in the location and design of the flare stacks. It should be pointed out that the mountainous centre of the island lies immediately upwind of the stack site. The movement of wind across this mountain is likely to cause downwash of air pollutants onto the industrial complex itself. The likelihood and extent of this problem cannot be determined without a computer simulation of dispersal under local conditions.

Solid waste

A maximum of 500 m^3/year of oil sludge will be derived from the separators. This will be "farmed" in a 2,500 m^3 concrete basin. An incinerator will also be constructed to dispose of other combustible wastes.

The presence of scavenging seabirds on the island will make the proper management of the island's solid waste disposal site imperative.

Hazardous materials	' The comments made concerning
	' Ruwais under these headings
Industrial hygiene and Safety	' apply similary to Zirku,
	' although the physical setting
Sociological aspects	' will result in different consequences.

Summary conclusions concerning observations made at Ruwais and Zirku

The mission has considered its observations in Ruwais and Zirku in the light of the concepts of environmental assessment and pollution control. We conclude that the following activities are now required:

(i) Environmental Impact Assessment at Ruwais and Zirku.

(ii) Baseline studies at Ruwais and Zirku, followed by monitoring.

(iii) The establishment of an Industrial Area Authority at Ruwais to co-ordinate development , environmental assessment and pollution control.

(iv) The formulation of policies for the introduction and implementation of E.I.A. and pollution control within Abu Dhabi and the U.A.E.

(v) The formation of an institutional structure within the Higher Environmental Committee (H.E.C.) to put those policies into practice.

(vi) The formation of an administrative structure within ADNOC to further develop the company's environmental responsibility.

Set out below are suggestions as to how these activities could be executed.

ENVIRONMENTAL IMPACT ASSESSMENT AT RUWAIS AND ZIRKU

Approach

When new developments are being considered (including the present construction phase), or major extensions of existing plants are being planned, it is recommended that a fully structured E.I.A. be undertaken. Many countries have now produced guidelines as to how E.I.A can be undertaken as have several international agencies and organizations. Functions of the guidelines can be as follows:

(1) To clarify procedures in the E.I.A process.

(2) To provide a detailed explanation of E.I.A. procedures for a particular activity, sector or type of decision.

(3) To provide guidance on how to undertake a full E.I.A., or some aspects of the E.I.A. One example of the various stages in an E.I.A. system is included in Figure 6.

It is suggested that in the long term it will be desirable that an E.I.A. system be developed which reflects the specific local environmental needs. In the short term, however, it may be necessary to utilize existing E.I.A. systems including the production of an Environmental Impact Statement (E.I.S.). It is suggested that the E.I.S. should contain the following information:

a) Description of the development proposal

This section of E.I.S should include:

(i) details of the plant and its processes;

(ii) key siting criteria;

(iii) alternative sites considered;

(iv) land requirements;

PRELIMINARY ASSESSMENT PROCEDURE

Step 1 Identify Problems and Specify Alternatives
- State problems and requirements
- Nature and extent of each alternative

↓

Step 2 Assemble Available Data
- Collect data relevant to each site and process/operation alternative
- Reference to national/international lists of priority chemicals.

↓

Step 3 Assess Staff Competence
- In-house sufficiency or external assistance required?

↓

Step 4 Initial Impact Identification
- Review of site and process alternatives in relation to the available data on the existing environment
- Identification of impacts via an "interaction" matrix

↓

Step 5 Preliminary Assessment
- Application of Screening Tests - are there any potential adverse impacts generated by the proposed development?

NO → No Further Assessment Required

↓ YES

DETAILED ASSESSMENT PROCEDURE

Step 6 Preparation & Execution of Detailed Baseline & Process Studies
- Define terms of reference for further environmental assessment tasks; appoint appropriate specialists
- Execution of detailed studies - data collection & analysis

↓

Step 7 Identification/confirmation of Potential Adverse Impacts
- On existing environment
- Initial consideration of appropriate constraints during construction and operational phases of the development

↓

Step 8 Impact Assessment
- Assessment of impacts of the project activities in terms of their exposure, nature, reversibility, directness and cumulative and synergistic effects

↓

Step 9 Summarize and Present Findings
- Summary sheet
- Provisions for follow-up surveillance and monitoring

Figure 6: A guide to assessment procedures for proposed developments

(v) employment requirements;

(vi) infrastructure requirements;

(vii) environmental data (such as noise, vibration and effluents);

(viii) emergency service requirements.

It is desirable that this section of the E.I.S. should be a factual account of the proposal. The known facts of the proposal should be clearly distinguished from the predicted impacts included in later sections of the E.I.S. It may not be possible to produce accurate forecasts of all features of the development, for example the expected workforce. In such cases an indication of the degree of reliability of the estimates should be included.

b) Baseline studies

The baseline studies will assemble data on the physical characteristics, ecological characteristics, human activity patterns, infrastructure, social and community service provision and existing levels of environmental pollution in the local area. This section of an E.I.S. may contain a brief description of the local area under each of these six sub-headings. Attention should be focused on the most significant aspect of the areas such as rare, unique or fragile features which are likely to be disrupted by the development. Other features which might be constraints on the development, for example limited sewerage capacity, should also be discussed.

c) Potential impacts

This section of the E.I.S. will contain a summary of the appraisal of potential impacts. Although the E.I.S. will draw on a wide range of detailed studies and reports, they should be written succinctly and with a minimum amount of technical language. The technical information on which they are based can be appended. The description of impacts should be as factual as possible, and where uncertainties exist these should be clearly stated. Impacts discussed should include those which would have a serious effect, even if they are unlikely to occur, together with an indication of their probability.

d) Mitigating actions

The E.I.S. should include a section on mitigative measures which can be undertaken to reduce adverse effects. In retrospective E.I.A., such as could be conducted for existing plants like the refinery at Ruwais, ameliorative measures should be recommended if possible.

e) Effects of existing trends

Changes which are predicted to take place in an area should development not proceed are as significant as the expected impacts of the development. It is important that known trends and other factors which might influence the future of the area are analysed in detail because an estimate of the future for the area without the proposed development is an important consideration in determining the decision on the proposal. The effect of the development on existing trends is also important. When detailed data on environmental trends are not available, an E.I.S. may indicate the changes that are thought to be occurring at present and estimate rates of change.

f) Consultations

Comments received from consultees such as government departments and other developers may have played a part in determining the scope of the E.I.S. This section of an E.I.S. could usefully include a summary of comments received and an indication of how they have been taken into account in assessment. Comments from consultees may be appended in full for anyone wishing to read the detailed comments.

g) Major Issues Report (Summary)

It will be useful to summarize the findings of an E.I.S. This can be achieved by use of a Major Issues Report which analyses and interprets the implications of the options open to decision-makers. It could contain a brief statement of the most important issues and a consideration of features which are a matter of inference and interpretation. Technical language should be avoided. Organizing the material should be less of a problem than in an E.I.S.; in many respects the structure may reflect that of the E.I.S., although additional sections are included. Throughout the report it would be valuable to cross-reference to sections of the E.I.S. where more detailed discussions of particular topics can be found.

h) Implications of alternative decisions

The implications of granting or refusing permission to develop are assessed in this section. Consequently, the significance of the impacts identified in the previous section and how they can be avoided or ameliorated will be discussed. The discussion of impacts should be sufficiently detailed to indicate such factors as the number of jobs created and the environmental degradation involved if the development were to proceed. In discussing the implications of refusal the contents of the section of the E.I.S. concerned with existing trends and the probable changes in the area without the development should be analysed. The range of conditions which could be imposed on the development if permission were to be given such as the enforcement of certain pollution standards should be covered and a discussion of their effectiveness in reducing the adverse impacts of the development should be included.

Structure

Annex II is a draft brief for a multi purpose water scheme which suggests how an E.I.A. for a major development could be structured. It is included as being indicative of the range of topics that can be included in an E.I.A.

It is also strongly recommended that when an E.I.A. is being undertaken, use should be made of two guidance manuals. These are:

- Environmental, health and human ecologic considerations in economic development projects. World Bank, May 1974.

- "Guidelines for assessing industrial environmental impact and environmental criteria for the siting of industry". UNEP - Industry and Environment Guidelines Services, Vol. 1. 1980.

Both these reports provide specific guidance on how to conduct an E.I.A. and include specific techniques of assessment that can be employed. Until the U.A.E. produce their own guidance manual it is strongly recommended that the advice contained in these two documents be used when assessing new development and major extension of existing industrial complexes.

Organization

Introduction

The launching of environmental impact assessment procedures and environmental control regulations for large-scale industrial sites like Ruwais and Zirku require the implementation of a number of activities. In some cases the initiation of an activity may be wholly dependent upon the previous completion of another activity. For example, in order to conduct an inventory of industrial processes for an area, it is first necessary to define the limit of the area to be studied as well as the objectives of the study. In other cases one or more activities my be implemented simultaneously since they do not affect each other directly, as with baseline assessment activities and activities to develop environmental policies and regulations. Finally, one or more activities may have an heuristic relationship: i.e. where the results of an activity or group of activities may form the basis for modifying the implementation of a continuing activity already underway. An obvious example of this is the modification of the sampling programme of a baseline survey on the basis of the evaluation of preliminary results.

Definition of study area(s) and objectives

In order to carry out a qualitative and quantitative environmental impact assessment as well as to develop and implement environmental policies and regulations, the first step is to define the geographical coverage of the area or areas to be surveyed and the overall, as well as specific, objectives to be accomplished.

In defining areas for conducting E.I.A. the interrelationship between environmental factors as well as between various development projects must be taken into account. For example, it would be impossible to get an accurate picture of the environmental problems near the Ruwais industrial complex without taking into consideration the adjacent Jebel Dhanna oil loading and exporting terminal. Because of their proximity the environment of one site will be affected by the environment of the other. Furthermore the surrounding region will, obviously, be affected by both sites. The industrial activities and processes taking place at Ruwais and Jebel Dhanna are also interrelated. This applies on a more expanded scale also: i.e. what takes place in Ruwais may indirectly affect what takes place in other locations of the U.A.E. For example, the commissioning of the new refinery at Ruwais might result in a decision to change the range of products to be produced at the Um El Nar refinery.

Many considerations must therefore be taken into account when defining the geographical extent of the E.I.A. exercise. The resulting decision may then take form of a simple geographic definition which could be represented by a line indicating the designated study area on a map or it may be a more complex definition which takes into account the interrelationships between two or more complexes.

The question of defining objectives of an E.I.A. study needs to be approached on two levels. One level is primarily technical. It concerns specifics, such as identifying qualitatively the types of pollutants that will be emitted from certain industrial plants and at what concentrations in air or water or other medium, and how these will affect workers, the neighbouring population or other organisms or groups of organisms (e.g. fisheries etc.) and to what extent geographically as well as physiologically these effects will take place. On another level, the objectives involve a complex set of value judgements concerning aesthetics, tastes, importance of the health of an exposed population, economics, traditions, sometimes religious and even moral values as well as many others.

As an illustrative example consider the positive and negative effects that a chlorine production plant may have on the surrounding area. On the positive side the production of chlorine may supply a local market more economically than if chlorine were imported, and may thus decrease local dependence on outside sources. Further, it may supply outside markets competitively enough to assure the plant operators and workers of an income, security and other benefits. On the negative side, if the plant uses mercury as a catalyst which leaks into the surrounding environment it may affect the health of workers or a nearby population. If lost to the sea, it may affect the suitability of marine organisms for consumption. In the latter case this might mean a loss of livelihood for fishermen dependent upon the affected area. Thus, an objective on a technical level would be to quantify the amount of mercury which could potentially be lost to the environment, the potential amount absorbed by workers and the neighbouring population, and the possible physiological consequences. An additional objective would be to quantify the mercury that would be taken up by edible marine organisms and predict the possible consequences both to consumers and to fishermen who would lose income if the organisms they supply were determined to be no longer consumable.

On the level of value judgements, the pros and cons of the positive and negative effects of the chlorine plant must be weighed against each other. On one extreme, a decision could be made against having a chlorine plant in order to protect people's health and the fisherman's livelihood, whilst on the other hand it could be to construct the plant at a risk to people's health and the fisherman's income. In between these extremes regulatory limits must be established to control the chlorine plant's emissions of mercury. This may result in modification in design which may in turn change the economics of the operation. Such proposed steps then have to be weighed against the resulting gains in health of the affected population and livelihood of the fishermen. The objectives of no mercury emissions, or highest economic benefit with acceptance of some risk to the environment, or some compromise between the two, will be the result of value judgements.

Deciding objectives on a technical level and a value judgement level should be co-ordinated and harmonized rather than the two levels being decided in isolation from each other. The best way to carry out the decision-making process for defining the study areas and the objectives is in a meeting or, if necessary, a series of meetings. The meeting(s) should involve representatives from all government and private sectors having an interest in the development site or study area. If a series of meetings are held, it may be better if the initial ones are attended only by persons more familiar with national or local interests so that national or local objectives can be more clearly defined and that these definitions serve as the basis of discussion in later meetings when persons representing a broader spectrum of interest attend.

Baseline assessment

The major activity in an E.I.A. for Ruwais or Zirku will be the conduct of baseline assessment. This involves two parallel sets of activities; one in assessment of the natural environment, the other is assessment of the man-made environment. In both cases the assessment follows a similar course of events based on the objectives and geographical definition discussed above. These are:

(i) assembly, collation and review of existing data;

(ii) identification of inadequacies in existing data;

(iii) formulation and implementation of activities to obtain the additional information necessary.

As illustrated in Figure 7 and explained below, these two sets of activities can be conducted in parallel.

These parallel activities then merge so that the information from each is used to formulate the baseline studies which are explained below. The individual elements in the assembly, collation and review of existing data are as follows:

(a) Establishment of an inventory of industrial processes and materials and product balance for present and future plans.

In planning the baseline assessment it is necessary to identify the pollutants to be measured, where they should be measured, how often and at what levels they are likely to occur. This information can be derived by identifying the industrial processes that will be located in the defined study area as well as identifying and quantifying the feedstocks or raw materials and products of the industries. Using this information together with established methodology, it is possible to predict which pollutants are most likely to be released to the environment and to estimate the quantities of each pollutant released.

Therefore, the first step is to conduct an inventory of the present and planned industries for the study area. In conducting the inventory, information must be gathered about the specific processes the industries will employ, the design specifications, the rate of consumption and by-products. Much of this information may be gathered through engineers' plans and specifications already available for the individual plants. Once a regulatory agency is formed either in a Government department or in the form of an Industrial Area Authority (see page.43) it will be possible to demand this information from developers, in the form of a project specification report (see Annex III) and list of questions (e.g. see Annex IV) which would be drawn up to suit local needs.

By gathering the existing specific information it would then be possible to identify inadequacies on which a further information-gathering exercise could be planned. This may take the form of working with the engineering companies who are developing projects in the study area. Once a fairly detailed inventory of the industries of the study site becomes available, the calculation of expected pollution can take place.

In summary, it will be necessary to:

(i) compile a list of industries operating or planned for the defined study area;

(ii) quantify the feedstocks, raw materials and final products;

(iii) identify inadequacies in the information and repeat (i) and (ii) until information is sufficient.

(b) Conduct a quantitative and qualitative analysis of pollution expected in the study area

With the information gathered in a) together with established methodology the identity as well as expected levels of pollutants can be calculated. See for example, Figure 2 which illustrates a flow diagram for a typical petroleum refinery. At the various stages from the entry of crude oil into the refinery to the emergence of the product, the most likely pollutants to be produced can be predicted on the basis of empirical knowledge of other established refineries as well as knowledge of the chemistry of the refining processes. Some of these pollutants are indicated on the flow diagram. The amounts of the pollutants generated at each step can then be calculated on the basis of crude oil input rates, product output rates, the size of the refinery and known coefficients which have been derived empirically from studies of many other petroleum refineries. These predictions, together with knowledge of the environmental conditions where the refinery is located will be used to assist in the formulation of a plan for conducting baseline field studies.

(c) Review existing information on environmental conditions

The pollutants generated in the study area will be affected, transformed, taken up, carried and dispersed or concentrated by the environment they enter. Knowledge of the environmental conditions of the area is therefore essential in determining the importance of the pollutant arisings. Information on environmental conditions must therefore be assembled, collated and reviewed. A partial checklist of conditions to be reviewed is:

(i) Meteorology
- temperature profiles
- wind speed and direction
- air stability
- climatology
- precipitation
- humidity

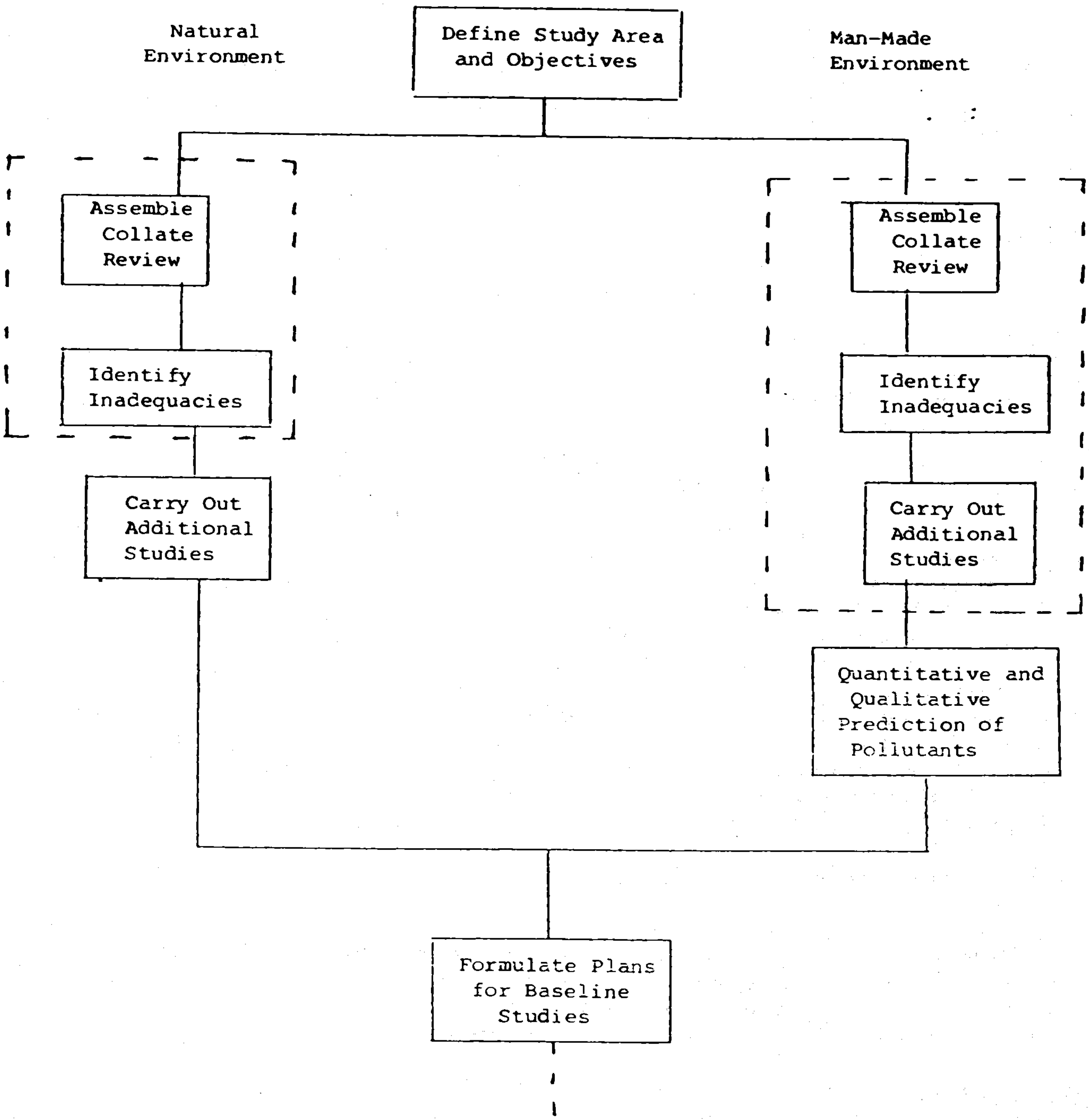

Natural Environment
Define Study Area and Objectives
Man-Made Environment
Assemble Collate Review
Identify Inadequacies
Carry Out Additional Studies
Assemble Collate Review
Identify Inadequacies
Carry Out Additional Studies
Quantitative and Qualitative Prediction of Pollutants
Formulate Plans for Baseline Studies

Figure 7

(ii) Hydrography
- depth profiles
- sediments
- bottom geology

(iii) Oceanography
- waves
- currents
- tides
- salinity
- temperature
- turbidity
- nutrient status
- metal concentrations

(iv) Marine biology
- phytoplankton
- zooplankton
- fish
- benthic communities
- reef communities
- bacteriology

A considerable number of consultants' reports have been produced which describe currents, tides, waves and meteorology of the Ruwais and Zirku study area. These are mostly related to port development or the siting of offshore oilfield equipment. Fewer studies have been reported of other environmental conditions or of marine biology and fisheries. Existing information must be gathered and analysed in order to identify inadequacies and to prevent duplication of previous work during the baseline studies of the natural environment, which are discussed in the next section.

Baseline studies

a) Baseline studies of natural environmental conditions

On the basis of the information gathered and the inadequacies identified above a detailed field study of environmental conditions should be planned and carried out. This study will of necessity be conducted in several stages including the following:

(i) Formulation of overall strategy and plan in the light of the requirement of the subsequent impact assessment.

(ii) Formulation of a short-term plan and organization of the work to be carried out including:

- identification of samples to be taken, location of sampling and frequency;
- formulation or adoption of sampling and analytical procedures;
- identification of equipment needs;
- planning for sampling logistics;
- formulation and adoption of reporting procedures.

(iii) Initiation of a pilot phase survey which would include quantifying enviromental conditions described in c) above.

(iv) Periodic evaluation of pilot phase data and modification of sampling strategies and plans on the basis of the results.

(v) Formulation of new long-term strategies in anticipation of the requirements of the environmental impact assessment.

b) Baseline studies of pollutants

It will be necessary to conduct baseline studies of pollutants in parallel with the baseline studies of environmental conditions. The necessary steps for doing this are:

(i) compile a checklist of important pollutants;

(ii) predict on the basis of process information how and where pollutants will diffuse or migrate through the environment;

(iii) predict on the basis of environmental data how pollutants will diffuse or migrate through the environment;

(iv) formulate a scheme for measuring important pollutants including:

- sampling and analytical methodology;
- location of sampling points;
- frequency of sampling

Steps (i), (ii) and (iii) will have been accomplished during the baseline assessment of man-made environmental conditions described on page 32 (Baseline assessment). A partial checklist of pollutants for necessary baseline measurement at Ruwais and Zirku is as follows:

Seawater	Air
- Biochemical and Chemical oxygen damand (BOD; COD)	- H_2 - CO
- Heavy metals (e.g. cadmium, lead, mercury)	- SO_2 - NH_3
- Total and specific petroleum hydrocarbons	- NO_x - Particulates
- Toxic chemicals (e.g. sulphides, phenols)	- Mercaptans
- Nutrients (nitrates, phosphates, etc.)	
- Suspended solids	
- Coliform bacteria	

A more detailed listing and other information concerning these as well as the methodology for their measurement is presented in Annex V.

In reality, the baseline studies of pollutants will be carried out at the same time as the baseline studies of environmental conditions, as one baseline study programme. Indeed, in many cases the same parameters will be determined (e.g. in the case of metals which are both naturally occurring and are pollutants). However, the two studies have been separated at the planning stage to ensure that sampling stations, analytical techniques, etc., are selected which are suitable for both requirements.

It is envisaged that the baseline field studies will be continued as monitoring once plants are in operation. However, the number of sampling stations, frequency of sampling and parameters to be analysed might be reduced, depending upon the results of the baseline studies.

Study phasing

It is anticipated that the above programme of work would take two years. The phasing of the various elements of the E.I.A. would be as shown in the bar-chart (Figure 8).

Personnel requirements

(a) Qualifications and Terms of Reference

The number and type of personnel that would be required to carry out the various studies described above would depend very much upon how the work is to be organized, under whose auspices it will be carried out, and whether or not Ruwais and Zirku will be dealt with by the same personnel.

However, regardless of the above considerations, it is envisaged that the whole exercise will be carried out by two distinct teams: 1) a temporary project team which will conduct the initial activities i.e. the first eight months of the study; 2) a more permanent field team which will carry out the baseline studies of environmental conditions and pollutants, and which could continue these in an amended form ad infinitum as the environmental monitoring scheme if required. There will of course need to be some overlap between these two teams, and indeed, some personnel could be common to both teams, if available. The suggested composition of the teams is as follows:

PROJECT TEAM		Suggested Qualification (or equivalent)
Project Manager	Environmental scientist experienced in the conduct of Environmental Impact Assessment	Ph.D
Marine Ecologist	With experience of pollution studies	M.Sc.
Air Quality Expert	Capable of carrying out modelling studies	M.Sc.
Process/Chemical Engineer	Preferably with experience in petro-chemicals	M.Sc.
Sociologist/Economist	Preferably with experience of housing/industrial schemes in developing countries	M.Sc.
Research Assistant	Possibly with a background in planning	B.Sc.
FIELD TEAM		
Oceanographer/ Meteorologist	With field experience	M.Sc.
Marine Ecologist	Preferably with experience of tropical environments and pollution studies. (Preferably a scuba diver)	M.Sc.
Marine Chemist	" " " " "	M.Sc.

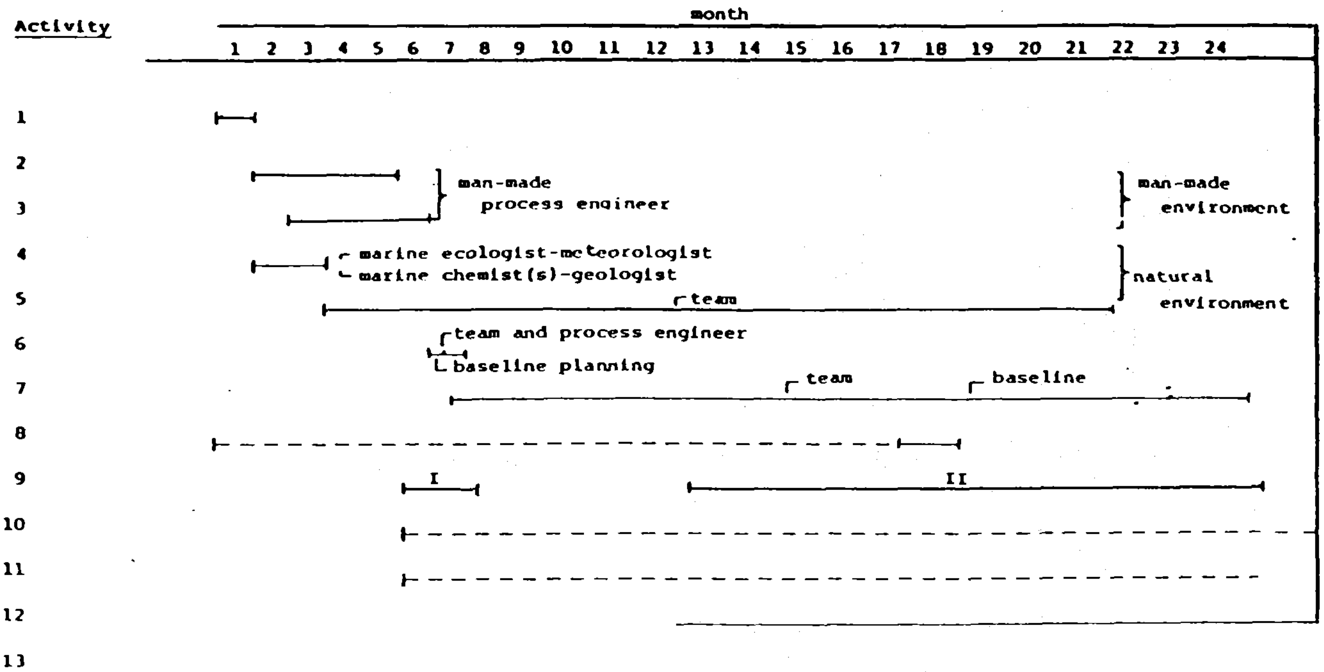


Figure 8: Phasing of Two Year EIA

Legend for Figure 8

1. Definition of study area and objectives

2. Establishment of inventory of industrial processes and materials and product balance for present and future plants.

3. Quantitative and qualitative analysis of predicted pollution for air, waste, process water, losses, liquid effluents (based on 2 above)

4. Review of existing information on environmental conditions (including meteorology, hydrography, geology, oceanography, and living resources)

5. Baseline study of environmental conditions (according to needs identified in 4)

6. Formulate a baseline study for pollutants (based on 3-5)

7. Carry out pollution baseline study

8. Establish guidelines for assessing proposed industries including assimilative capacity of the environment

9. Establish guidelines for assessing proposed industries including assimilative capacity of the environment

10. Develop regulations, guidelines and legislation for controlling environmental quality and procedures for their reassessment and modification (including intercalibration)

11. Establish administrative and legal structure for enforcing regulations and legislation and for their modification (including intercalibration)

12. Establish and implement environmental monitoring network

13. Implement environmental control regulations and the administrative structures for their enforcement and control

Analytical Chemist	Capable of dealing with samples of water, biota, soil and gas.	M.Sc.
Laboratory Instrumentation Technician	Capable of operating and maintaining sophisticated analytical equipment, e.g. spectrophotometer	B.Tech.
Field Technician	Capable of operating and maintaining field equipment for sampling and analysis	B. Tech.

In addition, assistance would be required from a driver, interpreter, secretary and boatman.

The exact composition of these teams, particularly the field team, will depend largely upon the skills and experience of available personnel. For example, the oceanographer may double as the marine chemist. A project manager will need to be appointed to direct the field team. He could either be one of the technical members of the team or could be a part-time additional member with a watching brief over the team's work.

(b) Operational procedure

The work of the two teams could be organized in a number of ways, and this will largely depend upon which of the options for conducting E.I.A. referred to below is finally adopted. As far as the work of the field team is concerned, three options for sample analysis would appear to be open, depending on the level of investment which is to be made locally in equipment, thus:

- Minimum: Wherever possible, analysis of environmental conditions and environmental quality to be made using direct-reading field instruments. Wherever possible, other samples to be analysed in the field by fairly unsophisticated colorimetric methods. Remaining analyses (e.g. for hydrocarbons, PCB's) to be conducted by specialist laboratories either within the region or elsewhere.

- Median: A mobile or transportable laboratory or laboratories to be supplied and fitted with all equipment needed for the measurement of environmental conditions and analysis of environmental samples. In this situation separate facilities could be made available for Ruwais and Zirku.

- Maximum: Permanent and fully equipped environmental laboratory or laboratories to be established, either as a central emirate/federation facility or separate facilties at each industrial complex.

Options for conducting E.I.A. at Ruwais and Zirku

There are three options for putting the above programme into action, as follows:

(a) ADNOC managed

If ADNOC were to adopt the measures suggested on page 48, the company would be in a position to manage the E.I.A. process itself. This would be done either by the company using its own full-time environmental staff or by having temporary staff under the direction of the company's proposed senior environmental scientist. The advantage of this would be that the company would have direct control of the project, and the personnel employed would hopefully have direct access to sites and information necessary for their studies. The disadvantage would be that considerable organization of resources would be required, and there would be therefore a long lead-in time before the E.I.A. process could begin.

(b) Consulting firm managed

The second option for conducting E.I.A. for these two complexes is to engage an international environmental consultancy. Total responsibility for carrying out the work, including project management, would then be taken on by the consultancy on a contract basis. It would then be possible for the work to be started straight away, with the consultancy deploying its own specialists where a unique expertise is required. The consultants could also supply all the necessary equipment for sampling and any analysis to be done in the U.A.E., either from their own stocks or by purchasing appropriate items. Consultants could be expected to provide an independent service, unaffected by internal company politics.

Clearly, to provide high quality expatriate staff for such a major project as this will require substantial financial backing; the client should therefore expect the consultant to provide a particularly cost-effective service. This objective could be met by consultants in two ways. Firstly, the team of consultants could conduct the Ruwais and Zirku E.I.A.s concurrently. This would be a fairly complex operation and would consequently require considerable co-operation from the client in terms of passes, transportation and accommodation. Secondly, the consultants could effect technology-transfer by working in close co-operation with local scientists seconded to the project. Indeed, depending upon the success of this exercise the permanent monitoring scheme into which the baseline studies will develop at the end of the 2 year programme could perhaps be taken over by local staff, with project management or occasional advice being provided by the consultants if and when required.

(c) UNEP managed

UNEP would manage the E.I.A. of one or both of the sites in question through one of several options. These management options would however, follow so far as possible the technical requirements for the E.I.A as discussed on pages 27-37. The various management choices are presented briefly below.

UNEP would have to have a legal basis for implementing a project or helping to implement a project on E.I.A. in the U.A.E. This could be based on a direct UNEP/U.A.E. country project which would be financed through funds in trust. A second possibility would be to integrate the proposed programme with the Kuwait Action Plan research and monitoring programme in which case UNEP would already have the necessary authority to operate but financing for the project would have to be through the KAP trust fund. This could be arranged by reaching an agreement with the Regional Organization for the Protection of the Marine Environment to include the E.I.A. of Ruwais and Zirku in the U.A.E. programme for the KAP. In this case the Regional Organization may consider providing partial funding for the E.I.A studies if they contribute to the overall goals of the Environmental Assessment and Management elements of the Action Plan. In case of either option UNEP would be able to provide substantive support in several ways. The only difference between the two options being that in the second case UNEP support would have to be defined and agreed by UNEP, U.A.E. and the Regional Organization instead of U.A.E. and UNEP alone.

The modalities for UNEP to manage or help manage the E.I.A. studies are several. These could take the form of helping ADNOC undertake the project by providing substantive support to the activities and proposals mentioned under "Options for conducting E.I.A at Ruwais and Zirku (a) and on page 48 of this report. By analogy UNEP could provide substantive support to the Higher Environmental Committee in implementing the guidelines presented under "Institutional Arrangements to implement E.I.A. in the U.A.E" (page 45). A third alternative would be to implement the E.I.A. studies independently of either ADNOC or the HEC more or less as a private company would undertake the programme. Fourth, if it were agreed that the E.I.A.s could be integrated into the KAP programme then UNEP/KAP would provide its substantive support through mobilizing the scientists and institutions participating in that programme. Finally, UNEP could manage the E.I.A. through engaging independent consultants or firms and act only as a management consultant for the project on behalf of ADNOC or the HEC.

In all the various options mentioned UNEP would follow the same principles which govern its Regional Seas Programmes in KAP and elsewhere, i.e. every effort would be made to utilize expertise and institutions from the Region and try so far as possible to include a training element in the E.I.A process so that the U.A.E. could eventually implement its own programmes.

ESTABLISHMENT OF AN INDUSTRIAL AREA AUTHORITY FOR THE RUWAIS INDUSTRIAL COMPLEX

It is suggested that one method of solving the existing and potential problems at Ruwais might be the formation of an Industrial Area Authority which will have the power to make and enforce pollution control regulations and conduct environmental assessment. This could possibly be formed by an extension of RISP. Such an authority would need a properly staffed, trained and equipped environmental department.

Ideally the authority should develop a pollution control strategy along the lines indicated in Figure 9, i.e. a strategy based on the principle of environmental impact assessment outlined earlier in this report. Such an authority already exists at the Shuaiba Industrial Area in Kuwait and, indeed, the Shuaiba Area Authority demand the sort of detailed information on any proposed new development which allows a type of environmental impact assessment to be made (see Annex III).

The environmental department of an Industrial Area Authority could therefore play a central role in the planning of future developments in the area.

An Industrial Area Authority would also be ideally placed to co-ordinate any environmental studies carried out by individual companies on the site. Moreover, it would be able to develop co-ordinated contingency plans and emergency procedures for the whole of the site. These could deal with:

- Oil spillage
- Spillage of toxic substances
- Releases of toxic or inflammable gases
- Explosion
- Fire
- Power failure

It is recommended that consideration be given to the commissioning of occasional Hazard and Operability Studies. This could be an irritant to the permanent Fire and Safety staff, but an independent external body can often identify potential risks in the methods of operation of the plant with which the permanent staff have become familiar. An arm of the Industrial Area Authority could also conduct or commission this type of work.

One further activity of the Industrial Area Authority could be to create a standard approach to industrial hygiene and draft regulations for the supply and use of such items as protective clothing, ear-defenders, goggles, face-masks and emergency first-aid equipment. It should be appreciated that the concept of an Industrial Area Authority has many parallels in the Port Authorities which have already been established to co-ordinate marine activities, for example, at the ADPPOC ports and at Jebel Ali. The structure of the Port Advisory Committee could also be reflected by an Industrial Area Authority Committee.

Existing

Features of the Population

- assessment of response and attitudes to existing environmental conditions
- local and regional variations
- diets

Features of the Natural Environment

- description of flora and fauna in each distinguishable region
- identification of particularly vulnerable or sensitive species
- conservation areas

Existing Environmental Conditions

- ambient air and water quality
- existing noise levels
- present level of air emissions and liquid discharges

Existing Environmental Legislation (if any)

- areas and topics covered
- procurement procedures
- efficiency of controls

Existing Pollution Control Practice (if any)

- type and efficiency of pollution control equipment
- waste treatment and disposal methods

Monitoring & predictions

Predicated Environmental Conditions

- predicted growth in type and number of industries, transportation, population etc.
- predicted effects on air quality water quality, noise levels, amenity, etc.

Identification of Present and Future Critical Problem Areas

Establishment of Monitoring Programmes

Identification of Environmental Requirements and Uses

- land use zoning
- classification of water bodies according to use, e.g. for drinking water, agriculture, fishing, amenity, recreation, waste disposal, etc.

Standards & Criteria

Development of Environmental Criteria

Criteria for predicting the chance or magnitude of effects caused by the most important pollutants on particularly sensitive receptors: should be developed with an awareness of technological and economic considerations

Formulation of Environmental Reference Levels e.g. standards, goals, objectives and guidelines.
Set in relation to health or amenity or in relation to economic effects e.g. damage to plants and materials

Control

Formulation of Pollution Control Policy

- comparison of best
- practicable means and air quality management approaches
- effluent standards versus water quality standards
- enforcement procedures
- incorporation of controls into legislation

Figure 9: Factors to be considered in a pollution control strategy

THE FORMULATION OF POLICIES FOR THE INTRODUCTION AND IMPLEMENTATION OF E.I.A AND POLLUTION CONTROL WITHIN ABU DHABI AND U.A.E

Introduction

Under "Environmental Impact Assessment at Ruwais and Zirku" (page 27) it is suggested that certain specific activities relating to E.I.A at Ruwais and Zirku should be undertaken. In this section of the report proposals are made as to how environmental policies, pollution control and E.I.A might be introduced within the U.A.E. and applied to both existing industrial complexes such as Ruwais and proposed new industrial development. This is followed later by suggestions as to the role that the H.E.C. might play in developing environmental policies, including E.I.A. and pollution control. Finally, a possible role for ADNOC in implementing E.I.A and pollution control will be considered under "The formation of an administrative structure within ADNOC to meet the company's environmental responsibility".

Development of environmental policies: long term strategy and interim measures

As yet there are no general environmental policies in operation throughout Abu Dhabi which have legal backing. This means that one of the first action that must be taken is to define the broad environmental policies that should be adopted, and the mechanisms required to implement them. By mechanisms is meant the laws required to achieve certain desired environmental objectives and also the administrative and regulatory systems and technical support that will be required.

It is suggested that policies will need to be formulated for the following topics:

- policies for air quality;
- policies for water quality;
- policies for noise;
- policies for liquid and solid waste disposal;
- policies for health;
- policies relating to risk and hazard;
- policies to maintain and improve the terrestrial and marine ecosystems;
- policies for social well-being and improvement of the quality of life for all the population.

It was not the main purpose of the mission to propose the type of laws and regulations that might be required to enforce environmental policy in the U.A.E. In the long term, however, such laws will be required to impose E.I.A. and pollution control on industrial complexes such as Ruwais. However, in the light of the information obtained from Ruwais it would appear that certain interim environmental policies must be introduced as a matter of some urgency. For areas such as Ruwais, it is suggested that one of the first actions that must be taken is to define a number of broad environmental policies for the industrial complexes and the surrounding areas. It must include all currently developed land, areas which may be developed at a later stage and land or sea in the vicinity where there is any possibility that the environment might be affected. It will be up to all of the interested parties and in particular the H.E.C. to define what should be the broad environmental policies. In the case of Ruwais the following interest groups will wish to be involved in the formulation of environmental policies: individual developers; the H.E.C. and government agencies concerned with health and pollution issues on land and at sea; ADNOC; representatives of the residents of the new housing development; local inhabitants.

Pollution control

Under "Baseline studies" (page 35) it is recommended that field studies should be undertaken. These studies will indicate for existing development the nature and amount of pollutants that are being produced by individual plants, and after analysis, may also suggest where environmental degradation or other adverse impacts appear to be occurring. Baseline studies should also indicate the quality of the environment in the surrounding area. The key question, however, is what does the analysis of the baseline assessment mean? What is the relationship between pollution being generated by an industrial complex and its effect on the surrounding environment? Are the impacts actually or potentially detrimental to the receiving environment whether this be land, sea or air? To answer these questions it is necessary to know whether the emissions are at a level which is considered acceptable or whether they are excessive and whether certain standards of acceptable quality need to be imposed.

Using evidence from the baseline studies it may be necessary, to implement procedures to improve environmental quality. To do this it is suggested that there may be a need to have both a short term policy and a long term policy.

The long term policy may require that certain standards and/or environmental quality objectives are defined and mandatorily enforced relating to aspects of the environment of the Emirates; the short term policy could be to adopt from elsewhere certain national or international standards relating to air, water, noise, health, etc.

Two main types of pollution control exist although there are others. First, emission standards place a limit on the amount of contaminant that an activity or facility of a given size can emit. Whilst relatively easy to enforce it represents an insufficient condition in itself for preserving environmental quality. Second, there are environmental quality objectives which set the levels of pollutants not to be exceeded in a given environment and geographical location. However, there are often problems with implementing environmental quality objectives. Based on evidence from elsewhere, it is suggested that consideration be given to using both standards and environmental quality objectives (E.Q.Os) in order to protect and maintain enviromental quality.

Ultimately it is recommended that certain emission and quality standards and E.Q.Os. be developed for the Emirates. However, until this has been achieved it is suggested that use be made of other national and international E.Q.Os and standards as a temporary measure. Annex VI contains details of a number of these. Specifically it is felt that the areas of greatest concern where standards and E.Q.Os should be introduced and should relate to, are:

- air pollution;
- aqueous discharges;
- solid waste disposal;
- health;
- risk and hazard.

Once baseline evidence is available it will be possible to decide which are priority areas for intervention on environmental grounds.

Turning specifically to Ruwais, a number of points can be made about pollution control. First there is the question of how environmental standards and regulations could be applied to existing installations at the Ruwais complex in advance of any national regulations which may be formulated. What may be required is the introduction of pollution standards in the interest of developers, the work force and the marine and terrestrial environment. As a stop-gap measure it may be possible to adopt certain standards and regulations on a temporary basis that have been adopted in other countries faced with a similar problem. In the long term however it will be necessary to formulate, administer and enforce regulations which must be promulgated by appropriate agencies in the Emirate Government.

Pollution controls may have to be introduced at Ruwais at two scales. First for individual installations (N.G.L. plant, Refinery, Urea plant, etc.) and secondly for the whole of the complex. As has already been shown one of the major environmental problems at Ruwais is that individual developers operate their plants to conform with the standards and specifications for items of equipment recommended by the suppliers of the equipment. This has led to a variation in the nature and type of standards. Given the way that the complex has developed this is perhaps inevitable. Suppliers have tended to use criteria that are in operation in their own country, or used internationally recommended standards. What has not been happening, however, is an environmental assessment of the potential aggregative effects of a number of quasi-independent developments. This is now required to be undertaken as a matter of some urgency.

The role of E.I.A. in assessing new developments and major extensions to existing installations

Under "Scope and Definition of Environmental Impact Assessment" it was suggested that one of the major uses of environmental impact assessment is by applying it to the assessment of new projects. It is clear that in the U.A.E. there will be a number of new major developments and at Ruwais new installations will be established on already earmarked sites, and extensions will be added to existing installations. It will therefore be necessary to formulate how E.I.A. could be utilized when major developments or major extensions are being proposed. The word proposed is emphasized because one of the major attributes of a fully structured E.I.A. system is that the evaluation should be undertaken concurrently with the technical and economic feasibility study. In this way alternative solutions to achieve the same desired economic results can be evaluated as to which is considered most environmentally acceptable.

Ideally it should be the U.A.E. Government which should state when an E.I.A should be undertaken. In practice, however, it may be some time before the Emirates agree on a policy which requires the introduction of a mandatory system of E.I.A. for certain specified projects. It is suggested therefore that as an interim measure the major developers who are located at Ruwais, together with Government agencies that have responsibility for environmental matters (Ministry of Health, and H.E.C.) and ADNOC, agree amongst themselves the circumstances when an E.I.A. should be undertaken. The form and content that the E.I.A. might take are defined on page 27. Furthermore, it is suggested that the same parties join together to establish a code of practice to conduct the range of tasks identified. The code of practice would cover the following activities:

(i) Detail of the baseline studies that the developers agree to undertake or which are made on their behalf.

(ii) Mechanisms for exchanging, on a continuous basis, the data obtained.

(iii) Adoption of certain effluent standards and E.Q.Os. agreed to by the Ruwais operators in consultation with the Ministry of Health.

(iv) Develop ongoing monitoring programmes.

INSTITUTIONAL ARRANGEMENTS TO IMPLEMENT E.I.A. IN THE U.A.E.

In earlier sections of the mission report a number of general and specific recommendations are made as to how E.I.A. could be developed in the U.A.E. and at Ruwais in particular. This section of the report makes a number of recommendations as to the kind of institutional framework of government that might be required to implement E.I.A. and identifies some of the major tasks that need to be undertaken.

It is recommended that the H.E.C. be encouraged to play a positive role in co-ordinating and developing an integrated policy for the environment in the U.A.E. As it now exists, the H.E.C. is a committee concerned with discussing and formulating broad policies for the environment. It is strongly recommended that the H.E.C. establishes a technical branch to (a) formulate and evaluate environmental policies, (b) introduce an E.I.A. system and (c) develop effluent standards and environmental quality objectives for the U.A.E.

There appear to be four main connected activities with which the H.E.C. should be concerned. Each will be considered in turn:

- Environmental Policy.

- Contingency plans for potential environment disasters.

- Introduction and enforcement of pollution standards.

- Formulation and implementation of an E.I.A. system.

- Detailed explanation of these activities follow.

Environmental Policy

(a) Formulate policies for key environmental activities which, from the evidence available, are felt to be actually or potentially damaging, such as:

  - storage of hazardous materials;
  - transport of hazardous materials;
  - dumping of liquid and solid waste;
  - the discharge of persistent pollutants;
  - the use of radio-active materials.

(b) Develop a legal framework for environmental policy in the U.A.E., to cover, contingency planning, pollution control and effluent standards, environmental quality objectives, E.I.A., baseline studies and monitoring.

(c) Co-operate with other Government departments to ensure that environmental issues are fully considered in the development of their activities.

It is recommended that officials of the H.E.C. visit a number of countries where environmental policies have been introduced, to gain first hand knowledge of the objectives and mechanisms of a structured environmental policy.

Contingency plans for potential environmental disasters

- Formulate and co-ordinate at the most appropriate scale (national/emirate/project) a number of contingency plans for environmental disasters. These might include:

  - oil spills;
  - explosion, gas release, etc. in major development complexes such as Ruwais and Jebel Ali;
  - fire in major industrial complexes, including jetties and in urban areas;
  - intake of pollutants into desalination plants.

Through the Kuwait Action Plan (KAP) the H.E.C. could seek advice from those countries that have been faced with a major disaster to evaluate their response and consider whether contingency plans that have been formulated elsewhere would be appropriate in Abu Dhabi or the U.A.E.

Introduction and enforcement of pollution standards

The H.E.C. could take the intitiative in developing a systematic policy towards pollution problems in the U.A.E. Specifically it is recommended that they be responsible for establishing:

- pollution control effluent standards, particularly for air, water, health and food;
- environmental quality objectives;
- environmentally sensitive areas in the U.A.E where strict pollution control policies should operate (coasts, water sources, etc.).

Formulation and implementation of an E.I.A. system

A number of different administrative structures have been used to implement E.I.A. and related activities. In some countries, legal procedures have been adopted which stipulate that all proposed projects being planned of a certain size, cost or with distinctive characteristics such as usage of certain chemicals, should be subjected to E.I.A. In other countries, E.I.A. is a non-legal strucuture to aid the development of more rational decision making, often as an adjunct to land use planning systems. In some countries, the development of E.I.A. has been closely connected with health programmes. It is recommended that the H.E.C. be made responsible for developing an E.I.A. system in the U.A.E. Specific action will need to be taken on the following topics:

(a) Development of the legal framework to introduce and implement E.I.A. This must ensure that E.I.A. be undertaken for all major new projects, major extensions and other activities likely to have an effect on the environment.

(b) Advising interested parties of the nature and scope of E.I.A. This will include requirements for baseline studies and monitoring.

(c) Producing general guidelines i.e. advice notes on E.I.A. methods and procedures and produce specific guidelines for individual project types. These will indicate the nature and form of assessments that must be undertaken. (In conjunction with the guidelines it is suggested that similar guidelines be produced relating to pollution. These could be of two types. First a general guideline to be made available to all interested parties of the broad objectives and mechanisms for introducing certain pollution standards. Second, guidelines for particular types of pollutants, i.e. guidelines on air pollution standards, water pollution standards, health standards, etc.).

(d) Evaluating the E.I.A.'s to be produced by the developer, or a consultant to be appointed jointly by the developer and the H.E.C., but paid for by the developer. The H.E.C. should have power to require that additional or complimentary studies be undertaken.

(e) Developing a technical capacity and having powers to insist on the monitoring programmes which should be introduced.

(f) Developing procedures for the scientific evaluation of environmental studies produced in the U.A.E. Initially this may require the use of outside experts, particularly for those major developments believed to be environmentally damaging, but ultimately the aim must be to increase the technical capabilities within U.A.E. to carry out the work.

(g) Assembling, codifying and disseminating existing studies which have been undertaken on aspects of E.I.A. in the U.A.E.

(h) Developing library facilities on procedures and methods of E.I.A. (and related matters) and disseminating this information to all interested parties.

(i) Evaluating resources available in the U.A.E. (Government, Universities, private developers) including laboratories and technical facilities which could be used to develop work on E.I.A. and considering how these could be improved.

(j) Establishing an environmental data bank. This could be used by the H.E.C. in carrying out their activities and would also be made accessible to all interested parties.

Several of the recommendations outlined above could only be implemented by the H.E.C. if a legal framework were created. However, much useful experience could be gained in developing E.I.A. by the H.E.C. if the concept of codes of practice for the Ruwais Industrial Complex was implemented. It would indicate how a non-mandatory system could work and this would be a useful input when legal frameworks are being formulated.

In order to achieve the above objectives for implementing E.I.A., it is suggested that the following staff resources and facilities would be required:

Staff

A staff of between 4 and 6 should be appointed to form the core of the scientific branch of the H.E.C. The chief should be a senior environmental scientist with wide experience of E.I.A. and other staff could include:

(1) an ecologist,
(2) a marine biologist,
(3) a pollution expert,
(4) a health expert/sanitary engineer,
(5) a land use planner/social scientist.

Facilities

The main facilities required will be a laboratory and associated technical staff.

THE FORMATION OF ADMINISTRATIVE STRUCTURE WITHIN ADNOC TO MEET THE COMPANY'S ENVIRONMENTAL RESPONSIBILITY

There is clearly a deep and growing concern in ADNOC and its associated companies about environmental matters. Many of the officials are committed to maintaining and improving the quality of the environment and it is suggested that ADNOC, because of their resources and influence, have a key role to play in the development of E.I.A., not only within the Company, but also by their example in the Emirates as a whole.

In the short term, i.e. during the period when a long-term environmental policy is being formulated, it is suggested that there are three distinct activities which ADNOC should consider in establishing an environmentally sound basis for major projects. These are:

(i) A pre-construction E.I.A., which should be fully integrated with the overall design, and associated pre-project environmental investigation including the setting up of baseline studies.

(ii) Monitoring and review of environmental impacts during construction. This could be done by appointing an ecologist or environmental scientist who would be attached to the project engineering team and who would report directly to the General Manager and to the appropriate Division of ADNOC. He would comment on environmental matters on a day to day basis, help establish baseline studies and assist in planning and preparing the post project monitoring programme.

(iii) Monitor the performance of the installation when it is operational and provide any information required by an independent review body (in this case the H.E.C).

It is realized that in the construction of projects ADNOC has a special relationship with contractors and consultants who have responsibility for project design, development and commissioning. This would mean that arrangements would have to be made concerning the appointment of an ecologist or environmental scientist, but the purpose would be to make an arrangement whereby independent scientific assessment of the likely environmental effects of projects can be supplied to ADNOC.

In the longer term it is suggested that ADNOC consider restructuring their administrative arrangements for handling environmental matters. At the present time within ADNOC, and companies in which they have an interest, a number of people have responsibility for certain individual environmental topics. This could lead to lack of co-ordination, which could make it difficult to operate a fully intergrated environmental policy. An alternate possibility would be to appoint a full time staff comprising qualified environmental scientists covering a number of disciplines. They could be located in the most appropriate existing division of ADNOC and be responsible to the Department Head.

Alternatively, it is suggested that ADNOC consider establishing an Environmental Coordination Centre (ECC) within their organization, to be headed by a senior environmental scientist, who would co-operate with the needs to divisions and report directly to be General Manager of ADNOC.

The functions of the full time environment section or the ECC could be as follows:

(i) Formulate broad environmental policies within ADNOC in the interest of the company and as an example to the U.A.E.

(ii) Coordinate the environmental policies of those companies in which ADNOC has an interest so as to introduce more integrated environmental policies.

(iii) Establish laboratory facilities to allow baseline studies, monitoring and other environmental assessment to be undertaken.

(iv) Evaluate all major proposals for which ADNOC is directly responsible or associated, to ensure that environmental considerations are taken into account at the project design stage and that environmental standards are maintained during construction and operation of the plant.

(v) For those development sites where ADNOC is located, or where associated companies are located, i.e. Ruwais, to act as coordinator in formulating policies for the environment. This might include the development of codes of practice and contingency plans for fire, safety, risk and hazard, pollution (air, water, noise) and social impacts.

(vi) Assist the H.E.C. and its technical branch in the development of E.I.A. and sound environmental policies in the U.A.E.

(vii) Codify all environmental studies undertaken by ADNOC and associated companies so as to avoid duplication of effort. Make this information available to all interested parties and where necessary produce, or commission, environmental studies on topics for which information is required.

Several major international oil companies have now established Environmental Coordination Centres and all the evidence suggests that they are not only leading to sound environmental policies but also facilitating better working relationships within the company and with outside organizations such as United Nations Agencies. It is therefore recommended that officials of ADNOC visit a number of Environmental Coordination Centres to consider whether such a Centre might be created in their own company.

EDUCATION AND TRAINING IN E.I.A.

It is clear that at the present time there is a shortage of trained manpower both to conduct E.I.A. in Abu Dhabi Government departments and in ADNOC. It is therefore recommended that a number of activities be introduced for the education and training of personnel. Without this training many of the recommendations concerning E.I.A. and pollution control could not be implemented. Training could be of two forms which are not mutually exclusive.

Training in Abu Dhabi

It is proposed that a short course on the objectives and scope of E.I.A. be mounted for senior administrators in Government and industry.

A more intensive course on the practical aspects of undertaking E.I.A and pollution control should be initiated. It would be specifically for the technical officers in the proposed H.E.C. technical branch, Government and oil industry and would concentrate on the practical aspects of E.I.A. and pollution methods.

Through the KAP, co-operate with other States in the region in holding a workshop to discuss how E.I.A methods and procedures could be developed in Abu Dhabi and the KAP Region to the mutual benefit of all.

Training outside Abu Dhabi

Although in setting up environmental organizations in Government and industry, it may be necessary to bring in expertise initially, potential future employees of the H.E.C. technical branch and officials of ADNOC who will become involved in E.I.A. and pollution control should be encouraged to:

(i) be placed term placement in organizations conducting E.I.A and pollution control so as to gain practical experience of the workings of the system;

(ii) attend international conferences and workshops on E.I.A. and pollution control so as to broaden their understanding and knowledge of the scope and objectives of the subject.

ANNEX I

UNEP/IMO MISSION SCHEDULE

Date		Activity	Contacts
Sunday	22.3.81	Arrived Abu Dhabi	
Monday	23.3.81	a.m Formal introductory meeting at ADNOC Head Office followed by technical working meeting.	Mr. M.R. Nouar - Director, E & P, ADNOC Mr. A. Al Zaidan - Acting Coordinator of Kuwait Action Plan Dr. B. Clark - UNEP Dr. P. Driver - IMO Mr. A. Rabie - Ministry of Health (UAE) Capt. R. Fouillet - ZADCO Capt. P.Puijpe - GASCO Capt. M. Cooper - ADPPOC Capt. H. Shareef - ADNOC Mr. T. Tarbouche - ADNOC Mr. A. Mustafa - ADNOC Mr. R. Ali - ADNOC Mr.H.Schoonderbeek - ADNOC (FOD)
		p.m Working lunch at Intercontinental Hotel	
Tuesday	24.3.81	Review of site plans and various consultants' reports at ADNOC H.Q.	Mr. T. Tarbouche and Capt. H. Shareef
Wednesday	25.3.81	"	"
Thursday	26.3.81	a.m "	"
		p.m Meeting with GASCO marine Staff	Capt. R. Moreton (Marine Supt.) and Capt. P. Puijpe (Asst. Marine Supt.).
Friday	27.3.81	a.m Continued review of data at ADNOC H.Q.	Mr. A. Mustafa (ADNOC)
		p.m Depart by road to Ruwais/Jebel Dhanna	
Saturday	28.3.81	a.m Visit Ruwais Refinery construction site p.m Visit GASCO plant at 'gas-in' Visit ADNOC Ruwais loading jetty	Mr. A. Mustafa (ADNOC Mr. W. Jones (GASCO) Capt. R. Puijpe (GASCO)
Sunday	29.3.81	a.m Visit Jebel Dhanna Harbour Visit Ruwais housing complex p.m Depart by road for Abu Dhabi	Capt. M. Cooper (ADPPOC) Mr. A. Mustafa (ADNOC)
Monday	30.3.81	a.m Visit ADNOC refinery at Um El Nar Visit ADNOC chlor-alkali plant at Um El Nar p.m Visit Power and Desalination Plant at Um El Nar	Mr. A. Mustafa (ADNOC)

ANNEX I (contd.)

Date		Activity	Contacts
Tuesday	31.3.81	Visit Zirku Island	Capt. H. Shareef (ADNOC) Capt. A. Ducelier (ZADCO) Capt. Poncet (ZADCO) Mr. G. Bureau (ZADCO)
Wednesday	1.4.81	Visit Dubai Aluminium Co., Jebel Ali	Mr. A. Rabie (Ministry of Health), Mr. A. Tarbouche (ADNOC) Mr. R Bailey, Dr. P. Cook and Mr. E. Adkins
		Visit DUGAS, Jebel Ali Visit Gulf Extensions, Jebel Ali Visit Power and Desalination Plant, Jebel Ali Visit Jebel Ali Port Authority	Mr. Morimoto Mr. Kim Mr. George
Thursday	2.4.81	a.m Visit Dubai Petroleum Company Visit Port Rashid p.m Meeting with Dubai Municipality Depart for Abu Dhabi by road	Mr.T. Tarbouche (ADNOC), Mr. Prince Capt. M. Scott Mr. Hassan Mohammed, Mr.D. Bell and other Municipality officials.
Friday	3.4.81	Write summary report	
Saturday	4.4.81	Write summary report Mission receiption at Abu Dhabi Hilton	
Sunday	5.4.81	a.m Write summary report p.m Debriefing meeting at ADNOC H.Q.	

ANNEX II

DRAFT BRIEF FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (E.I.A) STUDY OF A MULTI-PURPOSE WATER SCHEME

Preamble

The brief proposes the main factors that should be taken into account by a group referred to as the ASSESSORS in preparing an E.I.A. of a multi-purpose water scheme. Throughout this the brief term "the Scheme" is used for convenience. It suggests the form that the E.I.A. might take together with a proposal on the methodology that could be adopted to undertake the study.

Background to the Study

Background information on the following topics will be required:

(i) A brief description of the current proposals for the Scheme and a summary of how these have evolved.

(ii) Details of the studies that have already been completed in the areas contained in these studies will be made available to the assessors and it should be indicated where these studies may be seen. A list of all available studies should be included as an Annex.

(iii) A statement of the various components that comprise the Scheme (dams, reservoirs, water transfer, irrigation, etc.).

(iv) Information on the scope, content and status of other studies which are to be commissioned on the Scheme. It should be noted that the E.I.A will be a parallel study to technical, feasibility and economic studies and each study must take into account the findings of other parallel work.

Objectives of the E.I.A.

The E.I.A. of the proposed Scheme will have five major objectives:

(i) To identify and describe, in as quantified a manner as possible, those aspects of the environment which will be affected by the various components of the Scheme (dams, reservoirs, waters, transfer, etc.) and the Scheme in total.

(ii) To analyse the effects that the various components of the Scheme, and the Scheme in total, would have on the environment, including negative and positive impacts, direct and indirect impacts, short and long term effects. The specific ways that the project proposals will minimize adverse impacts and maximize positive effects must be indicated.

(iii) To describe alternatives to the proposed Scheme, or parts of the Scheme, which would achieve the same results. The environmental impacts of these alternative proposals should be indicated and compared.

(iv) To co-ordinate the E.I.A. with any other studies being undertaken, i.e. engineering, technical and economic studies, and to undertake the study in the same period. To make the results of the E.I.A. study available to all other interested parties so that the findings can, if necessary, be used to modify proposals, assess alternatives and derive solutions which are compatible from a socio/economic and environmental point of view.

(v) To encourage active participation by all interested parties, including the public, in as positive a manner as possible.

Form of the E.I.A. Study

It is suggested that the following form be adopted for the E.I.A. study.

Introduction

(a) Purpose of E.I.A. study
(b) Scope of E.I.A. study
(c) Contents of E.I.A. study

Description of the Scheme

(a) Type of Scheme
(b) Location
(c) Description of the Scheme

Description of the Environment

A brief, but clear, description should be given of the environmental resources which will be perfected by the Scheme.

The list that follows should be thought as a check-list of factors which should be described. Some of the factors may not be relevant, whilst additional ones may need to be taken into account. Areas where the various components of the Scheme will be located together with the area covered by the total Scheme, should be described. For convenience existing environmental resources could be described under the following headings:

Physical Resources

Water	Surface Water	Hydrology	Quality	
	Ground Water	Hydrology	Quality	
Air	Climate	Air Quality		
Land	Soils Fertility	Erosion	Seismology	Minerals

Ecological Resources

Aquatic	Fisheries	Aquatic biology	
Terrestrial	Forests	Flora	Fauna

Human Resources

Water	Water supply	Flood control/drainage
Transportation	Road/rail	
Agriculture	Agriculture development	Aquaculture Irrigation
Power	Generation Transmision	
Population + Settlements		
Employment		
Land Use		

Quality of life

Social/Health	Public health	Public safety	Social Structure
Cultural	Archaeological	Historical	Cultural values
Visual/Amenity			

Environmental Impact Assessment of the Scheme - Methods

In assessing the impact of the Scheme, the Assessors should use an assessment method, or methods, which deal with the relations between components of environmental and social systems and between these two types of systems. Impacts, therefore, should be traced throughout individual systems and across systems. The number of ramifications considered for a primary impact (for example the effects of dam impoundment on fish numbers and hence fishing communities) will depend on the importance of the individual linkages and will be left to the professional judgement of the Assessors. All important links between initial effects caused by a project action, such as channelization and a final impact, for example loss of fishing income, should be analysed.

The Assessors should have descretion in choosing the most suitable method to show impacts (matrices, networks, quantitative methods, overlays, models, etc), but it is suggested that they should not use a method which involves weighting and aggregation of impacts to produce composite score incorporating the scores of all impacts. Results from the assessment should be presented in a tabular format with accompanying summaries.

Tables should be constructed for individual components of the total Scheme, that is, for reservoirs, irrigation schemes and means of water transfer etc. All impacts identified should be included, but especially significant beneficial and adverse impacts should be given more detailed treatment. In the tabular format a number of features should be discussed, whenever appropriate, for each impact. These features are:

(a) The probability of particular impacts occurring, including if possible some quantified estimates.

(b) Impacts with low probability of occurrence, but with potentially serious consequences.

(c) For all impacts, especially those considered to be significantly deleterious, appropriate mitigating measures should be discussed, for example creation of new habitats to replace those likely to be destroyed. Also, design changes which can minimize harmful impacts should be identified, e.g. to minimize pollution and increase standards of public health. If there were to be no mitigating measures, this should be stated. For all mitigating actions some estimate of the extent to which damage will be minimized should be provided.

(d) All impacts should be screened to determine whether there are any small scale changes, which may cause major disruption in environmental thresholds. Such impacts should be identified and their consequences discussed.

(e) Appropriate monitoring schemes for particular impacts or categories of impacts should be identified. Those environmental and social components which may indicate the state of larger systems should be identified. Monitoring schemes should be related to these factors which will give an indication of harmful changes in system quality in order to ensure that action can be taken to ameliorate them.

(f) For all impacts an indication must be given of their nature by indicating one or more of the appropriate characteristics from the list below:

- beneficial and/or adverse
- short term and/or long term
- reversible and/or irreversible
- local and/or strategic (regional/national)

The Assessors should identify and describe the differential distribution of social and economic impacts among different social groups and communities. They should examine the distribution of all such impacts between different social categories within a community and also between separate communities.

The analyses of impacts should constitute the main report. Specific techniques used to predict particular impacts, for example, water quality in different areas covered by the Scheme, should be omitted from the report of impacts. Instead they should be contained in supporting documents, accompanied by appropriate bibliographic references. Also, background information on the area to be affected should be minimized in the report of impacts. Discussion of impacts, which is the major objective of the study, should not be embedded in a mass of background data.

Components of the Scheme

In assessing impacts, the following components of the Scheme will need to be considered:

(a) Individual dams and reservoirs.
(b) Downstream effects.
(c) Power generation.
(d) Irrigation schemes.
(e) Water transfer.
(f) Mixing of water from different catchment areas.
(g) Underground abstraction.

Some of the impacts which may be expected from the components identified in paragraph 17 are listed below. They must be considered to the extent that they are applicable but other relevant impacts which become apparent must also be included. The list of expected impacts has been drawn up with components (a), (b) and (c) in mind although some of the impacts may also apply to (d), (e), (f) and (g). Additional impacts which may need to be considered for components (d), (e), (f) and (g) follow the main list. All impacts should be related to the existing environmental situation which already will have been described.

Physical Resources

Surface water-hydrology

Impact of the Scheme on hydrological regime. Effect of the Scheme on mass water balance.

Surface water-quality

Water quality after construction of dams. In reservoirs and all rivers in both catchment areas. Effect of storage on physical parameters, dissolved mineral constituents, biological parameters and appropriate pollution parameters.

Ground water

Impact of the Scheme on ground water quality/quantity in reservoir vicinity, downstream and rivers.

Soils

Impact of the Scheme on soil erosion in the watersheds.

Sediments and erosion

Estimate of sediments likely to accumulate in reservoirs, how this will be minimized and possible protective measures such as forestry. Downstream erosion due to scouring.

Air pollution

Assessment of any air pollution which may be created.

Climate

Assessment of any possible changes in microclimate. Likely effect on insect/pest densities.

Land: (see irrigation section below)

Ecological Resources

Aquatic - fisheries

Impact of reservoirs and water transfer on existing fisheries (commercial or recreation). Expected new fisheries situation in (a) reservoirs, (b) downstream, (c) deltas, (d) rivers. To what extent can the Scheme improve the overall quality and the ecosystem?

Aquatic biology

Expected new ecology in (a) reservoirs, (b) rivers, (c) deltas. Preventive measures and monitoring systems of change to the aquatic ecosystem.

Terrestrial ecosystems

- Wildlife: Impact of the Scheme on wildlife
- Fauna/flora: Impact of the Scheme on flora and fauna. New resources that could be created (i.e. wildlife reserves, etc.). Ecological impacts from habitat destruction.
- Forests: Impact of the Scheme on inundating forests.
- Reservoir ecology: Describe anticipated environment in any new reservoir created (i.e. fisheries, wildlife, physical and chemical properties, sanitation control on bank and reservoir, nature of drawdown, weeds, etc.).

Human Resources

Water

Impact of the Scheme on improving availability of water supply at national, regional and local level. To what extent will changed water regime affect water supply, particularly downstream on rivers and deltas?

Flood control/drainage

To what extent will the Scheme, directly or indirectly, assist flood control?

Transportation

Impact of the Scheme on existing transport system in the affected area.
Effect of changes proposed.

Agriculture: (see section below on irrigated land).

Aquaculture

Potential impact of the Scheme on any actual or planned aquaculture either in reservoirs, rivers or deltas.

Power

Link to technical/feasibility study but assess impact of the Scheme on rural electrification and also impact of transmission lines.

Population + settlements

Impact of the Scheme on settlement patterns and population distribution resettlement proposals and their impact on those who may be inundated by reservoirs.

Employment

Impact of the Scheme on local employment structure. Will recruitment of workers adversely affect any local industry?

Land-use

Effect of the Scheme on existing land use systems and future land use.

Quality of Life

Public Health

Expected impact of the Scheme in altering hazards of water-orientated diseases and any proposed corrective measures. Plans for provision of minimum community sanitation facilities in any new settlement to be located around the reservoirs, to enhance village living and to minimize water pollution. Identify any other public health/sanitation problem including effects of an influx of labour on health of labour force and local population.

Public safety

Hazard expected to occur during the period of dam construction and during normal period of operation. Preventive measures proposed and how this will link to settlement policy and existing distribution of population. Impact of dam burst from earthquake or other events. Likelihood of dam causing earthquakes.

Social structure

Social impacts from influx of a large number of mostly male construction workers. Effects of workforce on infrastructure and social service provision. Impact of temporary accommodation.

Culture

Assess the impact of the Scheme on existing archaeological, historical and cultural features. To what extent, and in what way could a corrective programme for salvaging or preserving these features be incorporated?

Visual/amenity

Visual impact of the Scheme and any mitigating actions required to reduce visual intrusion in high amenity areas.

For the following components of the Scheme additional impacts may need to be considered together with any others that become apparent during the assessment process.

Irrigation schemes

(i) Estimated impact of the Scheme on types and amount of crops to be produced, the resulting increase in food production and effects on diet and nutrition.

(ii) The effect of plans for the training of farmers to adjust to irrigated farming.

(iii) The impact of plans for distribution and use of irrigation water and whether it will be made available in an economic and reliable manner.

(iv) Assessment of the impact of drainage schemes and their adequacy in preventing soil water logging, prevention of alkalinity and salinity build-up, and in saline soil areas prevention in bringing ground salt to the surface.

(v) Review of water/soil quality parameters to ensure their continuing irrigation will not lead to loss in soil fertility.

(vi) Effect of the impact of return flows of irrigation drainage on river water salinity, and plans for re-use of return flows.

(vii) Use of the Irrigation System as a source of drinking water, for industrial development, for fishing, as a lubricant for liquid waste disposal or for other purposes.

(viii) Potential for agro-industrial development and its impact.

(ix) Impact of run-off from farming areas containing residues of fertilizers and toxic chemicals on stream ecology, and effects of toxic chemicals on terrestrial wildlife.

Water transfer

The transfer of water from one drainage basin to another may affect both basins. The impacts of removing water from a basin should be assessed, particularly in relation to characteristics of the water and the quality of water remaining. The implications of changes in water characteristics and quantity for flora and fauna, industrial use, domestic use and agricultural use should be investigated. Also, the effects on tourism should be described. In particular changes in delta ecosystems, dependent in part, on water from a basin should be investigated. Changes in delta ecosystems could result from alteration in silting patterns, nutrient balance and salt water intrusion caused by changes in fresh water flow. The effects of channel collectors should be considered in relation to erosion, flooding potential and resource sterilization (minerals, sand and gravel etc.).

The effect of building pipelines should be considered. In the case of the various alternative proposals for an underground pipeline from one basin to another, an attempt must be made to decide on environmental grounds which route would be least harmful (i.e. to reduce drainage disruption and habitat destruction). The implications of restricting development over, and in the vicinity of, the pipeline must be considered. Implications of the impact of building pipelines on the surface in connection with the irrigation scheme must also be evaluated (habitat destruction, severance, bursts, visual impact in high amenity areas, (etc.).

Mixing of water from different watersheds

(i) Differences, if any, between the characteristics of different watersheds, should be described. Such physio-chemical and biological features as pH, BOD, TOC, dissolved oxygen, suspended solids, hardness, pollutants, temperature and trace metals should be included in the description.

(ii) If differences were found to exist the effects of water mixing on aquatic flora and fauna should be investigated. The effects of potentiation and synergism should be included in the assessment.

(iii) The effects of mixed water on downstream uses, such as irrigation, drinking and farming should be described.

(iv) As well as examining the effects of mixing, the Assessors should ascertain whether mixing will result in the introduction of flora and fauna not present in the receiving water. If so, the effects of such an event should be discussed.

(v) In the context of examining the effects of mixing, the impacts of increased flow should be investigated. Increased flow may lead to a disruption of silting patterns downstream. The effects of any such changes on wildlife habitats, fishing and communications should be described. Should the silting patterns in a deltaic area be disrupted special attention should be directed to any effects.

Underground abstraction

The effects of increased abstraction should be discussed especially:

(i) Changes in level of water table.

(ii) Effects of this on habitats such as marshes.

(iii) Possibility of salt water intrusion or intrusion of other waters with different physio-chemical characteristics. The effects of such mixing on irrigation, drinking water and thus health, and dependent habitats should be evaluated.

(iv) Likelihood of landslides and erosion.

Final Issues Report

A Final Issues Report should be prepared which summarises and interprets the findings of the Environmental Impact Assessment. The report should stress the main impacts which have been identified but it should also contain an analysis of the following items:

(i) Mitigation of adverse impacts

Where a potentially adverse impact has been identified, consideration should be given as to how it can be minimized or mitigated. This may necessitate the proposal of alternative courses of action.

(ii) Improvement of the environment

Any major beneficial impacts of the Scheme should be identified and it should be suggested how these should be maximized to enhance the overall quality of the environment.

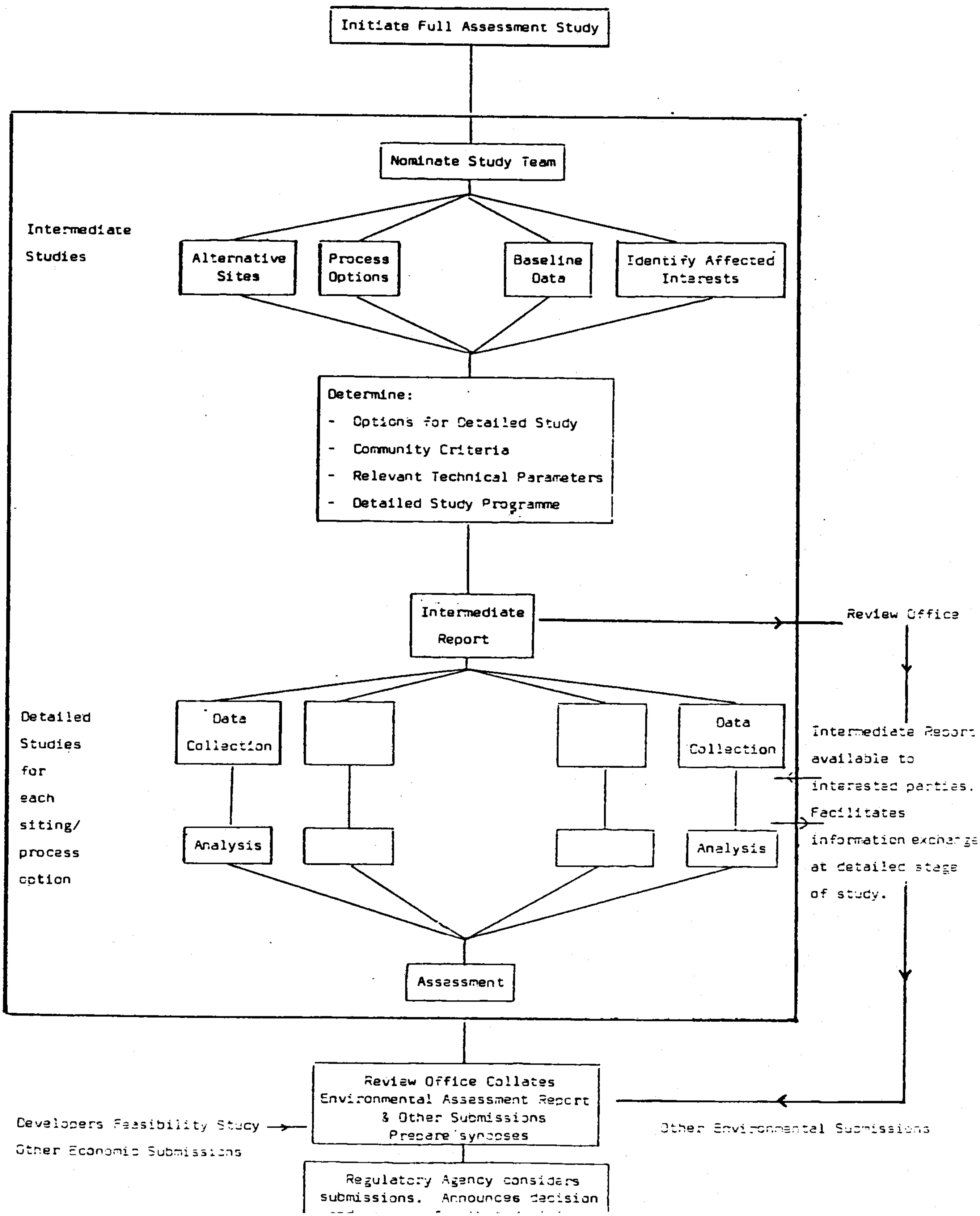
(iii) Monitoring

A system of monitoring and continued evaluation of the adverse and beneficial impacts of the Scheme should be considered and how any monitoring scheme adopted could be implemented.

In sum, the Final Issues Report should be thought of as a summary and conclusion statement on the E.I.A. of the Scheme. It should review the gains and losses to the environment which will result from the Scheme. Next it should explain how any necessary adverse effects will be minimized or offset or compensated for. Finally, it will indicate the provisions for follow-up surveillance and monitoring.

It is recommended that the Final Issues Report be produced in such a way that it is essentially a complete and understandable document in itself. In this way it could be distributed to Ministries, other Government agencies, specialists and the general public for purposes of public participation who would have access to the more detailed documentation should they so desire.

Stages in the full Assessment of Environmental Impact



ANNEX III

BRIEF FOR A PROJECT SPECIFICATION

REPORT AS USED IN THE U.K.

A Project Specification Report will assist the Planning Authority obtain information on the characteristics of a proposed development. A brief should be issued to a prospective developer, and it should specify the technical information that should be supplied with the planning application.

INTRODUCTION TO DEVELOPER

Your proposed development is on such a scale that it may have profound implications for the future of this area. Considerable information is needed to process your application. It is essential that this information is provided to permit the planning authority to assess the effects of the development on the site and surrounding area.

Unnecessary delay in processing your application will be avoided if the information required to make a detailed appraisal is provided at an early stage. The information should be as accurate as possible to minimise the time taken to reach a decision.

The information should be submitted in the form of a Project Specification Report which should be structured on the basis of all the sections covered by the following brief. Each section should contain both a detailed explanation of the technical data provided and also a statement of the sources from which the data are derived.

At the discretion of the planning authority, selected information may be circulated in confidence to any statutory or advisory organisations which the planning authority considers has expertise capable of contributing to an objective appraisal of your proposed development.

The onus is on the applicant to ensure that all information concerning the development is provided so that an objective and balanced appraisal of the proposal can be carried out. A Project Specification Report with insufficient information may be returned to the applicant for further completion and this will cause delay.

A.1 GENERAL

DEVELOPER		AGENT SUBMITTING APPLICATION	
Name	....	Name	....
Address	....	Address	....
	....		....
	....		....
Phone	....	Phone	....

Proposed development ....

Development site ....

....

A2 DETAILS OF THE PROPOSED PLANT AND ITS PROCESSES

Please provide details of:

- a The background of the company.
- b Experience in the particular industrial field to which the proposed development relates.
- c Partners and subsidiary company linkages.
- d Similar installations currently in operation of which the company has knowledge.

In addition please provide full details of:

- e The manufacturing processes to be used.

If future development phases are envisaged then indicate:

g .When these are likely to occur.

h Projected production capacities of the plant at these different phases

A3 THE CHOICE OF A SITE FOR THE PLANT

a **Please submit a list of all the alternative locations throughout the UK which were considered by the company.**

b **Please indicate on 1:25 000 scale OS maps all sites considered:**

i **Within the district, region or county where the planning application is being submitted.**

ii Within any adjacent region or county.

The essential siting criteria which must be achieved for the development to take place should be listed with as much detailed comment as possible. Some indication should be given as to why each particular site was eliminated in making a decision on the preferred site.

A4 PHYSICAL CHARACTERISTICS OF APPLICATION SITE

A4.1 Land requirements

Please provide on separate OS 1:2500 maps (or by means of a series of overlays) details of:

a The minimum area of land necessary for the current development.

b The area of the application if different from (a).

c The area for each additional phase of development if known.

d The total area of land owned by the applicant or subsidiary companies on or in the vicinity of the proposed site.

e The total area of leasehold by the applicant or subsidiary companies on or in the vicinity of the proposed site.

f The total area of any options held by the applicant or subsidiary companies on or in the vicinity of the proposed site.

In each instance clearly indicate the area in hectares.

A4.2 Site utilisation

Please complete the table below to provide details of all proposed major buildings and structures. See notes for details of specific terms used in the table.

Land use	Type of building/ structure	No. on site	Height	Width	Length	Base diameter	Load
Processing/ manufacturing							
Storage							
Office/administrative							
Car parking							
Others							

Notes

Base diameter	Only applies to circular structures, e.g. cooling towers, storage tanks, flare stacks, etc
Load	Is the weight bearing factor which each type of building or structure places on the underlying geological sub-strata
Storage	Where underground storage is envisaged additional information should be provided on the distance between caverns, the volume of each cavern and the level of the crown of the roof of each cavern.
Type	Relates to the function of a building not its design or colouration

In conjunction with this table please provide a layout plan at 1 : 1250 or 1 : 2500 scale showing :

- a The boundaries of the land to which the application relates, and the existing and proposed layout of the site including any proposed division of the land into plots.
- b The position of all existing buildings (including those on land immediately adjoining the site) and all proposed buildings, major installations, roads, perimeter fences, pylons and footpaths (distinguishing existing from proposed), indicating the ground floor level of all proposed buildings and the levels and widths of all proposed roads.
- c The proposed use of each building and of any land not being built upon.
- d Approximate proposed land surface contours at suitable intervals.
- e The position and width of all means of access to roads, distinguishing between existing, alteration to existing, and proposed new access.
- f Any trees or natural features to be retained and those to be removed.
- g The facilities for the parking of cars belonging to employees and their visitors.
- h Facilities for parking of other vehicles using the site.
- j A selection of photomontages showing the proposed development superimposed on the existing landscape from different angles and viewpoints.
- k Specific landscaping proposals to be undertaken to help relate the development to its surroundings. These proposals should be supplemented with an appropriate written statement.

A4.3 Marine site characteristics: applicable to coastal or estuarine installations

Please provide the following information when development at a coastal or estuarine site is proposed.

- a A general layout plan at 1 : 1250 or 1 : 2500 scale showing all installations to be developed below the high water mark and/or on the coastal edge.
- b Details of any proposed dredging operations. This should include a map showing all areas to be dredged, the quantity of material to be removed, the duration of dredging operations, and the place and method of disposal.
- c Details of the maximum length, draught and beam of the types of vessel that will be using the berthing facilities.
- d Number of berths and the appropriate deadweight tonnage of each.
- e Maximum number of vessels using berthing facilities (simultaneously or over a period of time).
- f The maximum depth of water required for channels and berthing facilities.
- g Details of any proposed modifications to the shoreline.

A5 EMPLOYMENT CHARACTERISTICS

Please provide information on the following aspects of the proposed project's employment characteristics. If work is to be undertaken by subcontractors, please ensure that they supply the information necessary to complete subsections A5.1 and A5.2.

A5.1 During the construction phase

- a How long will the construction phase be? —— months
- b What is the envisaged monthly (or approximate monthly) level of employment on the project during construction? Each box below represents one month.

Month

1	2	3	4	5	6	7	8	9	10	11	12

13	14	15	16	17	18	19	20	21	22	23	24

25	26	27	28	29	30	31	32	33	34	35	36

c Please indicate the envisaged structure of the peak construction labour force in the form of the table below, to cover all employees by occupation group, e.g. management, bricklayers, general labourers, etc.

Occupation group	Male	Female	Total
Grand totals			

d Please indicate what percentage of the labour requirements in each occupation group that it is hoped will be drawn from:
  i The district where the planning application is being submitted.
  ii The region or county in which the district is situated.
  iii Any region or county adjacent to that specified in (ii).
e Will the work require skilled labour? If so, give details of these in terms of types and numbers required.
f Will the workforce require training? If so, please indicate whether it is proposed to institute company training schemes or use local education facilities.
g How many shifts per day are envisaged? —— shifts
h Will the number of workers in each shift be the same? Please give details.

A5.2 When the development is operational
a Please indicate the envisaged occupation groups of the workforce in the form of the table below. All categories of labour should be included, e.g. management, machine operators, general labourers, etc.

Occupation group	Male	Female	Total
Grand totals			

b Please indicate what percentage of the labour requirements in each occupation group that it is hoped will be drawn from:
  i The district where the planning application is being submitted.
  ii The region or county in which the district is situated.
  iii Any region or county adjacent to that specified in (ii).
c Will the work require skilled labour? If so, give details of these in terms of type and numbers required.
d Will the workforce require training? If so, please indicate whether it is proposed to institute company training schemes or use local education facilities.
e What proportion of the workforce would be preferred in the following age groups? Please indicate in the form of the table below.

Age structure	Percentage Male	Female
16 to 19		
20 to 24		
25 to 29		
30 to 39		
40 to 49		
50 to 59		
Over 60		

f How many shifts per day are envisaged? —— Shifts
g Will the number of workers in each shift be the same? Please give details.

A6 FINANCIAL CHARACTERISTICS

Please indicate the anticipated total annual expenditure on labour at present prices.
a During construction.
b During first fully operational year.
Please indicate in the form of the tables the anticipated average annual income per head at present prices within the occupation groups specified previously.

During construction

Occupation group	Male	Female

During first fully operational year

Occupation group	Male	Female

Please indicate in the form of the tables below details of the value at present prices and quantity of all materials and equipment required for the proposed development.

Inputs during construction

Inputs*			Source of raw materials (%)			
Major inputs required	Quantity required	Annual expenditure	County† or region	Adjacent counties or regions	National	International

Note
*Raw material inputs during construction and operational phases includes semi-finished products such as steel pipes as well as basic materials such as alumina, sand and aggregates.
†County applies to the county administrative areas in England. Region applies to Scotland. Adjacent counties or regions includes all those bordering the county or region in which the development is proposed. National includes all other parts of the United Kingdom, excluding those already accounted for by the "county or region" or "adjacent counties or regions" categories. International incorporates any remaining trade.

Inputs when operational

Inputs			Source of raw materials (%)			
Major inputs required	Quantity required	Expenditure during first fully operational year	County or region	Adjacent counties or regions	National	International

Please indicate in the form of the table below destinations of major outputs.

Outputs when operational

Outputs	Destination of products (%)			
Major product outputs	County or region	Adjacent counties or regions	National	International

What local sources of raw materials are being considered to meet construction and processing requirements? Where applicable, specific site locations, and the type of material to be extracted, should be indicated on a 1 : 25 000 scale OS base map.

A7 SITE PREPARATION

Where earthwork operations and vegetation clearance are intended for site preparation and levelling, details should be given of the amount of material that will be deposited off-site. Specific site locations for deposition should be indicated on a 1 : 25 000 scale OS base map.

A8 INFRASTRUCTURE REQUIREMENTS

A8.1 Transport requirement:

Please indicate in the form of the tables below the various transportation needs of the proposal.

During construction

Transport mode: by road				
Inputs	Average vehicle load (metric tons)	Frequency i.e. vehicles per unit time	Maximum vehicle load (metric tons)	Frequency i.e. vehicles per unit time

Similar tables should be constructed and discussed for rail and water (sea, canals and rivers) modes.

Please give separately, specific details of the likely means of transport to be used by employees.

When operational

Transport mode: by road				
Inputs	Average vehicle load (metric tons)	Frequency i.e. vehicles per unit time	Maximum vehicle load (metric tons)	Frequency i.e. vehicles per unit time

Similar tables should be constructed and discussed for rail and water (sea, canals and rivers) modes.

Please give separately, specific details of the likely means of transport to be used by employees.

Outputs when operational

Transport mode: by road				
Outputs	Average vehicle load (metric tons)	Frequency i.e. vehicles per unit time	Maximum vehicle load (metric tons)	Frequency i.e. vehicles per unit time

Similar tables should be constructed and discussed for rail and water (sea, canals and rivers) modes.

Where materials are to be brought by rail state whether a rail link and sidings will be required and indicate the preferred routes and all alternative routes considered on a 1 : 25 000 scale OS base map.

Where a pipeline link or links are required please indicate the preferred route(s) and all alternative routes considered on a 1 : 25 000 scale OS map and give full details of size, type of use and number of pipelines. Also, please supply data on the maximum throughput capacity of each pipeline and details of pipelaying operations.

Where materials are to be brought by air state whether a landing strip or helicopter landing site will be required and indicate the preferred site and all alternative sites considered on a 1 : 25 000 scale OS base map.

A8.2 Water demand

Please indicate in the form of the tables below the likely level of water demand for the project, expected sources of

During construction

Purpose	Average demand (litres daily)	Peak demand (litres daily)	Average quantity recycled	% Source figure*	Type†
Domestic				Public	
				Private	
Processing				Public	
				Private	
Cooling				Public	
				Private	
Total				Public	
				Private	

*Please indicate what proportion of the water requirements the applicant wishes to be provided by public agencies, and what proportion will be supplied from private extraction schemes.
†Please indicate whether potable, untreated or sea.

When operational

Purpose	Average demand (litres daily)	Peak demand (litres daily)	Average quantity recycled	% Source figure*	Type†
Domestic				Public	
				Private	
Processing				Public	
				Private	
Cooling				Public	
				Private	
Total				Public	
				Private	

*Please indicate what proportion of the water requirements the applicant wishes to be provided by public agencies, and what proportion will be supplied from private extraction schemes.
†Please indicate whether potable, untreated or sea.

A8.3 Electricity demand
Please indicate the envisaged demand for electric power.

	Average demand	Peak demand	% Source figure*
During construction			Public
			Private
When operational			Public
			Private

*Please indicate what proportion of the electricity requirements the applicant wishes to be provided by public agencies, and what proportion will be supplied from private sources, e.g. on-site power generation. Please identify these sources, specifically. Where power generation is to take place on-site, full details of the type of installation to be used should be stated in this section of the report, together with details of any spare capacity available for feeding into the local supply network.

A8.4 Gas demand
Please indicate what level of demand is expected for gas.

	Average demand (MJ Daily)	Peak demand (MJ Daily)	% Source figure*
During construction			Public
			Private
When operational			Public
			Private

what proportion will be obtained from private sources, e.g. by-product of own or other nearby industrialist's production process. Please identify these sources specifically. Where gas is a by-product of own production process please indicate the extent to which any spare capacity may be available for feeding into the local gas supply network.

A8.5 Housing

It is recognised that the applicant will not be able to supply totally accurate information under this heading. Nevertheless, every effort should be made to limit uncertainty. When preparing estimates, the applicant should consider his likely recruitment pattern and also accommodation provision at similar establishments of which he has knowledge.

a Will a camp (e.g. caravans, billets, ship etc) for construction workers be required? If so, please give the following details.
  - i Proprosed site location and area on a map of 1 : 2500 scale.
  - ii Any alternative camp site locations considered on a map of 1 : 50 000 scale.
  - iii The range of facilities that will be provided at the camp.
  - iv The number of workers that will be accommodated.
  - v The applicant's intentions for the camp once construction work is completed.

b Does the applicant propose to build permanent homes in the area for employees? If so, please give details of the numbers.

c Please give details of likely land demand for permanent housing.

d Please indicate in the form of the table below the estimated number of houses required for incoming workers over a five-year period from the start of development.

Housing type	Annual housing demand				
	Year 1 19	Year 2 19	Year 3 19	Year 4 19	Year 5 19
Private sector purchase by employees					
Private sector purchase by company					
Private sector rental By employees					
Private sector rental by company					
Local authority rental					
Totals					
Cumulative per annum					

A9 ENVIRONMENTAL IMPLICATIONS

A9.1 Noise levels

Please give details of the noise levels that will be produced by machinery during construction in the form of the table below. The noise levels to be provided should relate to work area noise specifications (i.e. 1 to 3 metres from the noise producing plant). Information is also required on noise control and monitoring measures that will be implemented by the company during construction.

During construction

1	2	3†			
		Noise levels (in dBA)			
		Night		Day	
Main construction operations	Equipment and machinery to be used	Normal operation	In* emergency	Normal operation	In* emergency

*Figures given in the "in emergency" column should relate to the maximum possible noise level that could be emitted by a particular piece of machinery.

†For each of the four categories of operation noted in column 3 in the above table, please provide in the form of the table below a set of octave band readings. The following table represents one of these "night time : normal operation."

Main construction operations	Equipment and machinery to be used	Noise levels (in dB) for octave band centre frequencies (Hz) during night time : normal operation							
		63	125	250	500	1K	2K	4K	8K

Please construct similar tables showing "night time: emergency operation," "daytime: normal operation" and "day time: emergency operation."

Please give the likely site boundary noise levels for both daytime and night time in dB(A) during construction.

When operational
Please provide tables as above, showing the noise levels from the proposed development when operational.

The likely boundary noise levels in dB(A) when fully operational should be given.

Please specify in detail the nature of the noise to be emitted from the plant when operational. Indicate:

a Whether or not the noise is continuous. If the noise is not continuous, how long does the typical noise event last? What percentage of the total time is the noise heard during day time and night time? (The time periods representing day time etc. should be obtained from the local authority.)
b The tonal characteristics of the noise during both day time and night time: Does the noise have a definite distinguishable constant note (whine, hiss, screech, hum, etc)?
c The nature of any impulsive irregularities in the noise during both day time and night time (e.g. bangs, clangs, thumps, etc) and whether the character of the noise is irregular enough to attract attention.

Similar information should be provided for periods of emergency operations.

A9.2 Vibration
Vibration is an important factor to take into consideration as it can lead to personal annoyance or discomfort and also damage to property. Please provide full details of all operations, particularly during the construction period, which will have vibration effects. The expected intensity of the vibrations resulting from each operation should be indicated in terms of amplitude (mm per second) and frequency (H_z). Please submit the results of any "site calibration" test shots undertaken.

A9.3 Flood lighting
Please indicate the location and power of any flood lights to be used during both construction and operational phases.

A9.4 Gaseous emissions
High level (chimneys, stacks etc)—Please give details of the high level gaseous emissions resulting from the operation of the various processing units in the proposed development. Any gases or vapours, even in trace form, arising from stacks should be listed in the "waste emitted" column. Where more than one stack is envisaged for a particular processing unit, separate information should be provided for each individual stack.

Types of processing unit	Types of waste emitted	Maximum amount emitted $\mu g/m^3$	Average daily emission level	Proposed stack height(s)	Diameter of exit	Volume of gases m^3/sec at working temperature	Exit velocity of emissions in m^3/sec	Exit temperature of emissions °C

In addition, for any boilers please give details of:
a The maximum continuous rating in MJ/hour.
b Maximum rate of fuel consumption.
c Type of fuel to be used.
d Sulphur content of fuel.

Low level—Please give details of low level gaseous emissions resulting from the operation of the various processing units in the proposed development. Any gases or vapours, even in trace form, arising from the various gaseous outlets, e.g. low level valves, forced draught ventilators or aeration ponds, should be identified in the "Waste Emitted" column. Please provide detailed information for each potential source.

Type of Processing unit	Type of gaseous outlet(s)	Type of waste emitted	Maximum amount emitted $\mu g/m^3$	Average daily emission level	Volume of gases m^3/sec at working temperature	Exit velocity of emissions	Exit temperature of emissions

In the event of pollution control mechanisms ceasing to operate give details of the maximum rate of emission from each source.

A9.5 Particulate emissions

Please give details of the particulate emissions resulting from the operation of the various processing units in the proposed development. Where more than one stack is envisaged for a particular processing unit, separate information should be provided for each stack. The form of particulate matter arising from each stack should be listed in the "waste emitted" column. For each type of waste emitted maximum and minimum figures of particle size should be noted and also the corresponding quantity of particles of a given size emitted daily. Please give details of monitoring schemes which will be installed on the site.

Type of processing unit	Types of waste emitted	Proposed stack height	Diameter of stack exit(s)	Average daily emission level	Maximum amount emitted $\mu g/m^3$	Volume of gases m^3/sec at working temperature	Exit velocity of emissions	Exit temperature of emissions	Particle size	Maximum quantity of particles of a given size emitted daily
									Max	
									Min	
									Max	
									Min	
									Max	
									Min	
									etc	

A9.6 Odours

It is recognised that no instruments are available for the measurement of intensity of odours. Wherever possible information should be supplied on the types of odours likely to result from the various installations on the site with particular reference to intractable odours. Please provide details of proposed control measures.

A9.7 Dust

Dust nuisance can be considerable depending on the processes and activities involved during both construction and operational phases. This can be particularly serious during dry periods. Please give details of the maximum dust level expected during dry weather conditions (measured in $\mu g/m^3$) and the measures proposed for monitoring and control, especially if dusty material is to be transported.

A9.8 Aqueous discharges
Where the operation of the proposed development will result in aqueous discharges of trade effluents to:

a Sewers.
b Rivers, canals and other watercourses.
c Lakes and static waters (including aquifers and lagoons).
d Estuaries and coastal waters.

In each case, please provide full details in the form of the table below using the list of Effluent Quality Parameters given in A9.9. Where more than one outfall is envisaged, please provide a separate table for each. Reference need only be made to those effluent quality parameters which are relevant to the proposed development. This should include any parameters which are known to the applicant, but not included in the list.

Sewers

Effluent quality parameters	Maximum daily average	Daily average	Periodic discharges	
			Maximum discharge	Time period of that discharge

Details should also be given of:
e Pollution control, including prevention of rain water run-off from site reaching any of a–d above.
f Monitoring schemes which will be installed on the site.

A9.9 Effluent quality parameters

Temperature of effluent
Temperature of cooling water
pH value
Conductivity
Dissolved oxygen (minimum)
Ammoniacal nitrogen
Total oxidised nitrogen
Suspended solids and ash
Chloride
Orthophosphate
Total phosphate
Alkalinity
COD value
BOD value
BOD value (inhibited)
4 hour permanganate value
Anionic detergent
Non-ionic detergent
Light transmission
Chlorophyll
Fluoride
Sulphate
Silica
Non carbonate hardness
Calcium
Magnesium
Sodium
Potassium
Manganese
Iron
Boron
Total dissolved chromium
Cadmium
Nickel
Lead
Arsenic
Zinc
Copper
Total mercury
Selenium
Vanadium
Cyanide (uncomplexed)
Phenols
PCB
Organohalogens
Organosilicons
Polyaromatic hydrocarbons
Oil
Tritium
Alpha radiation
Beta radiation
Strontium 90
Ruthenium 106

A.9.10 Solid or liquid wastes or by-products
These should include toxic liquids and sludges not disposed as effluents. Please give details in the form of the table below of all types of solid waste produced by the various processing units and their method of disposal.

Types of processing plant	Types of solid waste produced	Maximum daily quantity of each type	Disposal characteristics		
			Mode of transport to be used	Method of disposal	Proposed disposal site

A10 EMERGENCY SERVICES

A10.1 Fire and medical services
Please give details of the safety precautions that will be taken to prevent fire or explosions during both construction and operation.
Despite stringent safety procedures, major emergencies sometimes occur. Please provide details of the types of major emergencies that could arise from the industrial process used in the proposed development and indicate what facilities will be available on site to control and minimise effects.

A10.2 Security
If security fences, gatehouses, surveillance towers, radiomasts and flood lighting are to be built please supply details

A10.3 Control of pollution at marine facilities
Where a related marine facility, e.g. jetty or offshore pipline is envisaged, full details should be given of pollution control schemes which the applicant will operate to:

a Control accidental spillage of raw materials.
b Control and treat ships' ballast water.
c Control the quality of bilge water discharges.
d Control the disposal of sewage from ships.
e Collect spilt material.

ANNEX IV

LIST OF QUESTIONS

FOR DEVELOPERS AS USED IN THE U.K.

When considering the implications of a proposed development the planning authority will wish to identify the range of likely impacts that might occur if development proceeded. This list of questions should assist the planning authority determine those aspects which should be given detailed consideration. The questions should also aid interpretation of reports produced for the authority by consultants.

This list of questions has been designed to aid planning authorities assess major industrial developments. They can be used in several stages during appraisal of a proposed development but should be most useful when completing the Impact Matrix and utilising results from specific assessment techniques. Should a planning authority have to seek advice on specific impacts the questions may help their advisers supply the type of information that is required.

Although the questions cover a wide range of impacts they are not all-embracing. A planning authority may have to modify the questions or ask additional ones, depending on the nature of the site, surrounding area and the industrial processes associated with the development. Not all topics covered by questions will apply to every development. It is hoped that these questions will not only help reduce delays in assessing likely impacts but also help reduce the time taken to process applications.

WHERE APPLICABLE, THE PLANNING AUTHORITY SHOULD RELATE THE FOLLOWING QUESTIONS TO BOTH THE CONSTRUCTION AND OPERATIONAL PHASES OF THE PROPOSED DEVELOPMENT

PHYSICAL CHARACTERISTICS OF THE SITE AND ITS SURROUNDINGS

1 *Land*

a Does the geology of the area present problems with regard to the type of development under consideration?

b Does the development involve excavation or earthmoving which may have detrimental consequences, e.g. soil erosion?

c Does the general character of the local topography impose constraints on the design and siting of the proposed development?

2 *Water* (Technical Advice Note 1)

a Is the proposed development likely to affect the drainage pattern of the area?

b Is the proposed development likely to result in changes to other hydrological characteristics of the area?

c Is the proposed development likely to affect the flow of underground water?

Where the development is to take place at a coastal or estuarine location the following hydrographic factors should be taken into consideration:

d Are any proposed developments below the high water mark likely to affect the sea bed characteristics of the area?

e Are any of the hydrographic characteristics of the area likely to impose constraints on the design and siting of the proposed development?

f Where dredging operations are considered necessary are there any constraining factors which could influence or even prevent work taking place?

g Would any hydrographic characteristics in the area prevent satisfactory completion and/or operation of any part of the proposals?

3 *Climate*

a Are there any climatic factors relating to the area which could be constraints upon the proposed development?

b Are any climatic factors of the area (particularly inversions) likely to influence the pattern of pollution, e.g. noise and air pollution?

4 *Land use and landscape character* (Technical Advice Notes 2 and 3)

a Is the proposed development compatible with surrounding land uses, such as agriculture, forestry, recreation etc?

b Will the proposed development substantially alter the landscape quality of the area?

c Will the proposed development have a substantial zone of visual influence?

d How far are existing land-uses within the zone of visual influence compatible with the character of the proposed development?

e Is the scale of the proposed development compatible with that of the local landscape?

f Are there any trees or buildings on the site worthy of preservation?

g Are the materials to be used in the permanent structure and buildings of the development in character with those of the local area?

h Are the landscaping proposals submitted by the applicant satisfactory?

j Has consideration been given to a satisfactory scheme for site restoration should the proposed development cease operation? Has an appropriate means of financing the implementation of the restoration scheme been agreed should the company cease to be a viable concern?

ECOLOGICAL CHARACTERISTICS OF THE SITE AND ITS SURROUNDINGS
(Technical Advice Note 4)

5

a Are the development and the existing habitats compatible?

b If "yes" what conservation methods will be necessary to protect the habitats?

c (i) If the developer described conservation methods that will be used to protect sensitive habitats, are these likely to be successful?
(ii) Are the claims of the developer with respect to these conservation methods realistic?

d If the development and habitats are not compatible what communities will be at risk from:
Physical destruction?
Changes in groundwater level?
Changes in quality of standing or flowing water, oxygen content, salinity, turbidity, flow rate and temperature?
Chemical pollution, eutrophication and specific toxins?
Changes in silting pattern?
Air pollution of both water bodies and terrestrial habitats?
Dust deposition?
Changes in nutrient status of terrestrial habitats?

Opening up of other areas to increased recreation pressure by the construction of access routes, roads and pathways ?

e In each of the above cases what is the local, regional and national status of any habitats at risk ?

f What is the quality of the habitats regardless of status ?

g What dependent habitats or communities will also be at risk, including non-residents and migrants ? What is their status ?

h Can any of these habitats be recreated within a short period (5 to 10 years) ?

HUMAN ACTIVITY PATTERNS IN THE AREA

6 *Demographic aspects* (Technical Advice Note 6)

a What is the likely level of population growth in the area should the development take place ?

b Would such a level of growth be acceptable ?

c What is the likely effect of the development proposal upon local migration flows ?

d Is the envisaged level of population change likely to affect the existing age/sex structure of the area ?

e Are the envisaged population changes likely to affect the lifestyle, religious and cultural attitudes of the population ?

f Is the development likely to have an influence on the tourist trade of the area ?

7 *Employment structure* (Technical Advice Note 5)

a What effect will the development have upon the economic base of the area ?

b What industries are most likely to be affected by the proposed development ?

c Is the development likely to reduce unemployment in the area ?

d Will an improvement in the unemployment situation be temporary or permanent ?

e Is the development likely to take advantage of any spare labour capacity such as under-employment that exists in the area ?

f What are the implications of the applicant's stated labour requirements for the employment structure of the area ?

g Is the scale and rate of projected employment growth acceptable in the local context ?

h Will pressure be placed upon particular skills and age ranges ?

j Is the proposed development likely to result in a movement of labour away from existing employment in the area, and would this have any detrimental effects for the future ?

k Is the development likely to present a wider range of job opportunities for local school leavers than has previously been the case ?

l Is the development likely to result in a significant influx of non-local labour ?

m What would be the effect on the local labour market if the non-local construction labour remained in the area after the development was completed ?

8 *Transport* (Technical Advice Note 7)

a Is the development likely to lead to an increase in the volume of private transport (road, sea and air) in the area ?

b Is the development likely to lead to an increase in the volume of public transport (road, sea, rail and air) in the area ?

c Is the existing road network of an acceptable standard to carry the additional traffic without danger to other road users ?

d Would some other mode of transport prove more acceptable for transport of materials ?

e Is there likely to be any damage to the local environment adjacent to the proposed routes ?

f Could any traffic management schemes be introduced to reduce environmental damage and traffic hazards ?

g Could temporary access roads, where present, be put to community use after the construction period ?

h Would the development require additional road schemes to be implemented over and above the planned level of future provision ?

j Is the mode of transport proposed for the distribution of products acceptable to the planning authority, or should other alternatives be investigated ?

k Is the proposed development likely to influence the viability of rail services in the area ?

l Is existing rail capacity sufficient to meet any increase in traffic ?

m Where a rail link is proposed to the development site is this likely to have a detrimental effect on the local environment, and have alternative routes been considered ?

n Where a demand is likely for sea transport, does the area already have the necessary basic infrastructure ?

p If there is a need to construct berthing and other related facilities, is there likely to be any detrimental effect on the local environment ?

q Where a demand is likely for air transport, does the area already have the necessary basic infrastructure ?

r What are the likely environmental implications of providing such facilities, and are these compatible with the general character of the local area ?

INFRASTRUCTURE SERVICES

9 *Electricity*

d Are satisfactory emergency supply facilities provided in the event of a major power failure?
e In the event of a major power failure would there be a risk in terms of damage to the processing units, danger to the local community, and pollution of the environment?

10 *Gas*
a Will the proposed development lead to demands which exceed the planned level of provision in the area?
b How dependent will the development be upon public gas supplies?
c Where new pipelines are required, will these have any detrimental effects on the local environment?
d In the event of a major gas supply failure would there be a risk in terms of damage to the processing units, danger to the local community, and pollution of the environment?

11 *Water*
a Will the proposed development lead to demands which exceed the planned level of provision in the area?
b How dependent will the development be upon public water supplies?
c Will the development lead to the provision of additional abstraction schemes in the area or the construction of a new supply reservoir?
d Where new supply pipelines are required will these have any detrimental effects on the local environment?
e Are satisfactory emergency supply facilities available in the event of a major supply failure?
f In the event of a major water supply failure would there be a risk in terms of damage to processing units, danger to the local community, and pollution of the environment?

12 *Sewerage*
a Will the proposed development lead to demands which exceed the planned level of provision in the area?
b Are there any major constraints which would prevent the necessary facilities being provided?
c Where new pipelines would be required, are these likely to have any detrimental effects on the local environment?
d Are satisfactory emergency facilities available if the plant were to experience a major processing failure?
e In the event of a major processing failure would there be a risk to the health of the local community or pollution of the environment?

13 *Solid or liquid waste and by-product disposal*
a Will the proposed development lead to demands which exceed the planned level of provision of disposal sites in the area?
b Is there any danger to the local community of pollution risk from the types of waste products to be disposed especially from leakage to underground waters and thus to surface waters.
c Are satisfactory emergency facilities available in the event of a major processing failure?
d In the event of a major processing failure would there be a risk, particularly to the health of the local community and pollution of the environment?
e Will a new waste disposal site affect the visual amenity of the area?
f Is the proposed method of transporting the wastes safe and acceptable to the planning authority from the standpoint of existing transport facilities?

14 *Finance*
a What effects will the proposed development have on the financial programmes of relevant departments of the District Council?
b What effects will the proposed development have on the financial programme of relevant departments of the County or Regional Council?
c How significant will be the local area's share of revenue from raw material purchase?

Cross reference d to g to sub-section 7 (employment structure).
d How do the proposed wage rates during construction compare with those of existing employment in the local area?
e Where the construction wage rates are higher, is this likely to lead to a movement away from existing employment or restrict growth in locally important industry?
f How do the proposed wage rates during project operation compare with those of existing employment in the local area?
g Where wage rates during project operation are higher, is this likely to lead to a movement away from existing employment or restrict growth in locally important industry?

15 *Education*
a Will the proposed development lead to an increase in demand for specific types of industrial training in the area?
b Can this be catered for adequately at existing technical colleges or other education institutes?
c Will the development put pressure on existing standards of provision at nursery, junior or secondary schools in the area?
d Do any schools in the area have sufficient spare capacity to accommodate the influx of children of new families moving to the area?

16 *Housing*

a Will the estimated number of houses required for incoming workers necessitate additional land being released for housing development?

b Would the release of additional land for housing be environmentally acceptable?

c Would the release of additional land for housing development place an unacceptable strain on existing and planned infrastructure services?

d Does the development require emphasis to be placed on the private or local authority sectors of the housing?

e Would the type of housing required lead to possible social imbalance within the communities in which they were built?

f Where a construction camp, or alternative facility, is to be provided, is the site chosen by the proposed developer acceptable to the planning authority or should others be considered?

g Is the standard of provision of camp site facilities acceptable to the planning authority?

h Is the design and layout of the camp site facilities acceptable to the planning authority?

j Could a workers' camp or other housing facility be put to community use after termination of construction period?

17 *Telecommunications*

Will the proposed development interfere with existing telecommunication networks?

SOCIAL AND COMMUNITY SERVICES

18 *Health service facilities*

a What will be the effects of increased population arising from the new installation on existing facilities?

b Will the projected provision of health service facilities meet the increased demand?

c What additional provisions will be necessary?

19 *Emergency services—fire and ambulance*

a What will be the effects of the increased population arising from the new installation on existing services?

b Will the projected provision of services meet the increased demand?

c What additional provision will be necessary?

d In emergencies are the safety provisions and emergency services provided by the developer at the installation adequate?

e Are the existing local resources capable of dealing with any emergency?

f Is the time delay for arrival of local emergency services significant?

g What increased provision would be necessary to meet any emergency?

EXISTING LEVELS OF ENVIRONMENTAL POLLUTION

20 *Air pollution* (Technical Advice Note 8)

a Will the installation significantly alter the levels of atmospheric pollutants in the area?

b Will the release of atmospheric pollutants be a health hazard?

c Will inversion lead to a local build up of high levels of pollutants from the new installation?

d Will there be significant synergistic effects with existing pollutants in the atmosphere?

e Will the distribution of wind direction cause significant fumigation of areas sensitive to atmospheric pollution?

f Will the installation produce significant quantities of particulate matter which will be a nuisance to the local community?

g Will the installation produce offensive odours?

21 *Water pollution* (Technical Advice Note 9)

a Will effluents, treated or untreated, have a significant effect on the flora and fauna of the river, canal, lake, estuary or coastal waters?

b Will effluents find their way into surface water by means of underground waters?

c Are there stretches downstream where effluents are likely to change the flora and fauna?

d Will there be significant synergistic effects with existing pollutants in the receiving waters and/or between constituents of the effluents?

e Will there be significant potentiation effects with existing constituents of the effluents or receiving waters?

f Will the discharges lead to the build up of locally high levels of pollutants?

g Will variations in water flow (e.g. seasonal) cause a significant increase in the concentration of pollutants?

h Will salinity gradients and/or current movements in estuaries lead to locally high build up of pollutants and cause problems of dispersion?

j Will fishing (commercial and recreational) be affected by discharges?

k Will other water-based activities such as water-skiing, canoeing, sailing etc. be affected by discharges?

l Will there be any odour likely to cause offence?

m What dependent communities or species of animals and birds are likely to be affected by a change in the aquatic flora and fauna?

n Are there any sensitive plant communities dependent on the receiving waters for their supply which are likely to be adversely affected by discharges (including fines) from the development?

22 *Noise and vibration* (Technical Advice Note 10)

a Will the proposed installation significantly alter background noise levels?

b If these levels increase, will the introduced noise levels be of a magnitude to cause complaints from residents either during day or night-time?

c Will the levels have any adverse effect on the functioning of schools, hospitals, and old people's homes or on informal recreation areas either during day or night-time?

d Are the levels likely to have a significant effect on the wildlife of a Nature Reserve, Site of Special Scientific Interest, Local Nature Reserve or high quality habitat of local significance?

e Will the levels enhance an already existing situation of "creeping" ambient noise levels?

f If so, is this significant in the local context, especially if other installations are likely to follow?

g Will vibration from blasting, pile-driving, etc, cause human discomfort and annoyance?

h Will vibration cause structural damage to ancient monuments and other old buildings?

j Will vibration cause structural damage to other buildings, especially houses, schools etc?

23 *Radioactivity*

To what extent could radioactive waste have a significant effect on human beings, or animals and plants?

ANNEX V

U.S. EPA Test Procedures for Petroleum Refinery Effluents

Effluent Characteristics	Units	Status	Method	Reference and Page No.			
				1974 EPA Methods	14th ed. Stand. Methods	Pt. 31 1975 ASTM	USGS Methods
BOD_5	mg/l	A[1]	Winkler (Azide modification) or electrode method	-	543	-	50
TSS	mg/l	A	Glass fiber filtration, 103 to 105°C	268	94	-	-
COD	mg/l	A	Dichromate reflux	20	550	472	124
Oil & Grease	mg/l	A	Liquid extraction with trichloro-trifluoroethane-gravimetric	229	515	-	-
Phenolic Compounds	mg/l	A	Distillation followed by chlori-ometric (4 AAP)	241	582	574	-
Ammonia as N	mg/l	A	Manual distillation (at pH 9.5) followed by nesslerization, titration, electrode	159 165 168	410 412 616	237	116
Sulfide	mg/l	A	Titrimetric-iodine for levels >1 mg/l; Methylene blue photo-metric	284	505 508	-	154
Total Chromium	mg/l	A	Digestion followed by AA; or colorimetric (Diphenylcarba-zide); or by ICP	105 -	148 192	345 286	78 77
Hexavalent Chromium	mg/l	A	Extraction and AA; colorimetric (Diphenylcarbazide)	89 105	192	75	-

1. Approved test procedure

SOURCE: Environmental Protection Agency Regulations on Test Procedures for the Analysis of Pollutants. 40 Code Federal Regulations 136; Vol. 38 Federal Register 28758, October 16, 1973 (40 CFR 136; 38 FR 28758, October 16, 1973) Amended by 41 FR 52780, December 1, 1976; Amended by 42 FR 3306, January 18, 1977; 42 FR 37205, July 20, 1977; proposed Rules by 44 FR 69464, December 3, 1979; Amended by 44 Fr 75029, December 18, 1979.

ANNEX V
Page 2

Canada - Test Procedures for Petroleum Refinery Effluents

Effluent Characteristics	Units	Method	Reference & Page No's 13th ed. Stand. Methods
Oil & Grease	mg/l	Extraction using petroleum ether	255
Phenols	mg/l	Distillation followed by extraction with chloroform	502, 503
Sulfide	mg/l	Methylene blue photometric method	558
Nitrogen as Ammonia	mg/l	Manual distillation (at pH 9.5) followed by nessleri-zation, titration, electrode	453
TSS	mg/l	Glass fiber-filtration, 103 to 105°C	537

SOURCE: Canada - Guidelines Representing Toxicity of Liquid Effluent from Petroleum Refineries, 3 November 1973.

EFFLUENT STANDARDS AND ENVIRONMENTAL QUALITY OBJECTIVES FOR WATER AND AIR USED IN A NUMBER OF OTHER COUNTRIES

Table I: U.S. EPA Guidelines for Petroleum Refining Point Source Category

			Effluent Limitations (Kg per 1000 m^3 of Feed Stock)															
(kg/day			BPT[1]		BATEA[2]		NSPS[3]		PSES[4] (mg/t)		PSNS[5]		BAT[6] (kg/day)		ACT[7]	
Category	Effluent Characteristic	Status	1[8]	30[9]	1	30	1	30	1	30	1	30	1	30	1	30
A. Topping [14,19]																
1. General	BOD_5	A[10]	22.7	12.0	2.5	2.0	11.8	6.3			11.8	6.3				
	TSS	A	15.8	10.1	2.4	2.0	8.3	4.9			8.3	4.9				
	COD	A	117	60.3	10.0	8.0	61	32			61	32				
	Oil & Grease	A	6.9	3.7	0.50	0.40	3.6	1.9	100		3.6	1.9				
	Phenolic Compounds	A	0.168	0.076	0.012	0.009	0.088	0.043			0.088	0.043				
	Nitrogen as Ammonia	A	2.81	1.27	0.68	0.51	2.8	1.3	100		2.8	1.3				
	Sulfide	A	0.149	0.068	0.055	0.035	0.078	0.035			0.078	0.035				
	Total Chromium	A	0.345	0.20	0.124	0.105	0.18	0.105			0.18	0.105				
	Xexavalent Chromium	A	0.028	0.012	0.0026	0.0017	0.015	0.0068			0.015	0.0068				
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				
2. Runoff[19]	BOD_5	A	0.048	0.026	0.0105	0.0085	0.048	0.026			0.048	0.026				
	TSS	A	0.033	0.021	0.010	0.0085	0.033	0.021			0.033	0.021				
	COD	A	0.37	0.19	0.028	0.022	0.37	0.24			0.37	0.24				
	Oil & Grease	A	0.015	0.008	0.0020	0.0016	0.015	0.008			0.015	0.008				
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				
3. Ballast [19]	BOD_5	A	0.048	0.026	0.0105	0.0085	0.048	0.026			0.048	0.026				
	TSS	A	0.033	0.021	0.010	0.0085	0.033	0.021			0.033	0.021				
	COD	A	0.47	0.24	0.038	0.030	0.47	0.24			0.47	0.24				
	Oil & Grease	A	0.015	0.008	0.0020	0.0017	0.015	0.008			0.015	0.008				
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				

Table I: U.S. EPA Guidelines for Petroleum Refining Point Source Category (continued)

			Effluent Limitations (Kg per 1000 m^3 of Feed Stock)													
(kg/day			BPT[1]		BATEA[2]		NSPS[3]		PSES[4] (mg/t)		PSNS[5]		BAT[6] (kg/day)		ACT[7]	
Category	Effluent Characteristic	Status	1[8]	30[9]	1	30	1	30	1	30	1	30	1	30	1	30
B. 4. Cracking [15]	BOD$_5$	A	28.2	15.6	3.4	2.7	16.3	8.7			16.3	8.7			25.24K	13.91K
	TSS	A	19.5	12.6	3.2	2.7	11.3	7.2			11.3	7.2			17.35K	11.04K
	COD	A	210	109	19.2	15.4	118	61			118	61				
	Oil & Crease	A	8.4	4.5	0.68	0.54	4.8	2.6	100		4.8	2.6			7.89K	4.21K
	Phenolic Compounds	A	0.21	0.10	0.016	0.011	0.119	0.058			0.119	0.058	0.0351K	0.0170K		
	Nitrogen as Ammonia	A	18.8	8.5	4.6	3.5	18.8	8.6	100		18.8	8.6				
	Sulfide	A	0.18	0.082	0.075	0.048	0.105	0.048			0.105	0.048				
	Total Chromium	A	0.43	0.25	0.16	0.14	0.24	0.14			0.24	0.14	0.3812K	0.2234K		
	Hexavalent Chromium	A	0.035	0.016	0.0035	0.022	0.020	0.0088			0.020	0.0088	0.0326K	0.0147K		
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				
C. Petrochemical [16]	BOD$_5$	A	34.6	18.4	4.6	3.7	21.8	11.6			21.8	11.6				
	TSS	A	23.4	14.8	4.4	3.7	14.9	9.5			14.9	9.5				
	COD	A	210	109	22	17	133	69			133	69				
	Oil & Grease	A	11.1	5.9	0.90	0.72	6.6	3.5	100		6.6	3.5				
	Phenolic Compounds	A	0.25	0.120	0.022	0.015	0.158	0.077			0.158	0.077				
	Nitrogen as Amonia	A	23.4	10.6	5.6	4.4	23.4	10.7	100		23.4	10.7				

Table II: U.S. EPA Guidelines for Petroleum Refining Point Source Category

(kg/day			Effluent Limitations (Kg per 1000 m^3 of Feed Stock)													
			BPT[1]		BATEA[2]		NSPS[3]		PSES[4] (mg/t)		PSNS[5]		BAT[6] (kg/day)		ACT[7]	
Category	Effluent Characteristic	Status	1[8]	30[9]	1	30	1	30	1	30	1	30	1	30	1	30
C. Petrochemical[16]	Sulphide	A	0.22	0.099	0.099	0.063	0.140	0.063			0.140	0.063				
	Total Chromium	A	0.52	0.30	0.22	0.19	0.32	0.19			0.32	0.19				
	Hexavalent Chromium	A	0.046	0.020	0.0048	0.0031	0.025	0.012			0.025	0.012				
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				
D. Lube[17]	BOD_5	A	50.6	25.8	7.8	6.3	34.6	18.4			34.6	18.4			26.33AL	11.99AL
	TSS	A	35.6	22.7	7.4	6.3	23.4	14.9			23.4	14.9			18.10AL	11.52AL
	COD	A	360	187	40	32	245	126			245	126				
	Oil & Grease	A	16.2	8.5	1.4	1.1	10.5	5.6	100		10.5	5.6			8.23AL	4.39AL
	Phenolic Compounds	A	0.38	0.184	0.034	0.024	0.25	0.12			0.25	0.12	0.0265AL	0.0177AL		
	Nitrogen as Ammonia	A	23.4	10.6	5.6	4.2	23.4	10.7	100		23.4	10.7				
	Sulfide	A	0.33	0.150	0.16	0.10	0.220	0.10			0.220	0.10				
	Total Chromium	A	0.77	0.45	0.36	0.31	0.52	0.31			0.52	0.31	0.3975AL	0.2332AL		
	Xexavalent Chromium	A	0.068	0.030	0.0081	0.0052	0.046	0.021			0.046	0.021	0.0340AL	0.0154AL		
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				

Table II: U.S. EPA Guidelines for Petroleum Refining Point Source Category (continued)

(kg/day			Effluent Limitations (Kg per 1000 m^3 of Feed Stock)													
			BPT[1]		BATEA[2]		NSPS[3]		PSES[4] (mg/t)		PSNS[5]		BAT[6] (kg/day)		ACT[7]	
Category	Effluent Characteristic	Status	1[8]	30[9]	1	30	1	30	1	30	1	30	1	30	1	30
E. Integrated 18	BOD_5	A	54.4	28.9	8.8	7.1	41.6	22.1			41.6	22.1			2.195C	1.166C
		P[20]					No dischg.									
	TSS	A	37.3	23.7	8.4	7.1	28.1	17.9			28.1	17.9			1.509C	0.9601C
		P					No dischg.									
	COD	A	388	198	47	38	295	152			295	152				
		P					No dischg.									
	Oil & Grease	A	17.1	9.1	1.7	1.4	12.6	6.7	100		12.6	6.7			0.686C	0.366C
		P					No dischg.									
	Phenolic Compounds	A	0.40	0.192	0.041	0.029	0.30	0.14			0.30	0.14	0.0031C	0.0015C		
		P					No.dischg.									
	Nitrogen as Ammonia	A	23.4	10.6	5.6	4.2	23.4	10.7	100		23.4	10.7				
		P					No dischg.									
	Sulphide	A	0.35	0.158	0.19	0.12	0.26	0.12			0.26	0.12				
		P					No dischg.									
	Total Chromium	A	0.82	0.48	0.44	0.37	0.64	0.37			0.64	0.37	0.0332C	0.0194C		
		P					No dischg.									
	Hexavalent Chromium	A	0.068	0.032	0.0092	0.0059	0.052	0.024			0.052	0.024	0.0028C	0.0013C		
		P					No dischg.									
	pH	A	6-9	6-9	6-9	6-9	6-9	6-9			6-9	6-9				
		P					No dischg.									

1. Best Practicable Technology
2. Best Available Technology Economically Achievable
3. New Source Performance Standards
4. Pretreatment Standards for Existing Sources
5. Pretreatment Standards for New Sources
6. Best Available Technology
7. Best Conventional Technology
8. Maximum for any one day
9. Average of daily values for thirty consecutive days shall not exceed ....
10. Accepted (promulgated) guidelines
11. Total cracking process expressed in barrels/day
12. Total Asphalt - Lube Processes expressed in barrels/day
13. Total Crude processes expressed in barrels/day

1. BPT, BATEA, and NSPS limitations within the topping category must be multiplied by the following factors to calculate the maximum for any 1 day and maximum average of daily values for 30 consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day:	Size Factor
Less than 24.9	1.02
25.0 to 49.9	1.06
50.0 to 74.9	1.16
75.0 to 99.9	1.26
100.0 to 124.9	1.38
125.0 to 149.9	1.50
150.0 or greater	1.57

(2) Process factor

Process configuration:	Process Factor
Less than 2.49	0.62
2.5 to 3.49	0.67
3.5 to 4.49	0.80
4.5 to 5.49	0.95
5.5 to 5.99	1.07
6.0 to 6.49	1.17
6.5 to 6.99	1.27
7.0 to 7.49	1.39
7.5 to 7.99	1.51
8.0 to 8.49	1.64
8.5 to 8.99	1.79
9.0 to 9.49	1.95
9.5 to 9.99	2.12
10.0 to 10.49	2.31
10.5 to 10.99	2.51
11.0 to 11.49	2.73
11.5 to 11.99	2.98
12.0 to 12.49	3.24
12.5 to 12.99	3.53
13.0 to 13.49	3.84
13.5 to 13.99	4.18
14.0 or greater	4.36

2. BPT, BATEA, and NSPS limitations within the cracking category must be multiplied by the following factors to calculate the maximum for any 1 day and maximum average of daily values for 30 consecutive days.

(1) Size factor

1,000 bbl of feedstock per stream day:	Size Factor
Less than 24.9	0.91
25.0 to 49.9	0.95
50.0 to 74.9	1.04
75.0 to 99.9	1.13
100.0 to 124.9	1.23
125.0 to 149.9	1.35

(2) Process factor

Process configuration	Process Factor
Less than 2.49	0.58
2.5 to 3.49	0.63
3.5 to 4.49	0.74
4.5 to 5.49	0.88
5.5 to 5.99	0.10
6.0 to 6.49	1.09
6.5 to 6.99	1.19
7.0 to 7.49	1.29
7.5 to 7.99	1.41
8.0 to 8.49	1.53
8.5 to 8.99	1.67
9.0 to 9.49	1.82
9.5 or greater	1.89

3. BPT, BATEA, and NSPS limitations within the petrochemical category must be multiplied by the following factors to calculate the maximum for any 1 day and maximum average of daily values for 30 consecutive days.

(1) Size factor

1,000 bbl of feedstock per stream-day:	Size Factor
Less than 24.9	0.73
25.0 to 49.9	0.76
50.0 to 74.9	0.83
75.0 to 99.9	0.91
100.0 to 124.9	0.99
125.0 to 149.9	1.08
150.0 or greater	1.13

[40 FR 21939, May 20, 1975]

(2) Process factor.

Process configuration:	Size Factor
Less than 4.49	0.73
4.5 to 5.49	0.80
5.5 to 5.99	0.91
6.0 to 6.49	0.99
6.5 to 6.99	1.08
7.0 to 7.49	1.17
7.5 to 7.99	1.28
8.0 to 8.49	1.39
8.5 to 8.99	1.51
9.0 to 9.49	1.65
9.5 or greater	1.72

4. BPT, BATEA, and NSPS limitations within the lube category must be multiplied by the following factors to calculate themaximum for any 1 day and maximum average of daily values for 30 consecutive days.

(2) Process factor

Process configuration:	Process factor
Less than 2.49	0.58
2.5 to 3.49	0.63
3.5 to 4.49	0.74
4.5 to 5.49	0.88
5.5 to 5.99	1.00
6.0 to 6.49	1.09
6.5 to 6.99	1.19
7.0 to 7.49	1.29
7.5 to 7.99	1.41
8.0 to 8.49	1.53
8.5 to 8.99	1.67
9.0 to 9.49	1.82
9.5 or greater	1.89

3. BPT, BATEA, and NSPS limitations within the petrochemical category must be multiplied by the following factors to calculate the maximum for any 1 day and maximum average of daily values for 30 consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream-day:	Size factor
Less than 24.9	0.73
25.0 to 49.9	0.76
50.0 to 74.9	0.83
75.0 to 99.9	0.91
100.0 to 144.9	0.99
125.0 to 149.9	1.08
150.0 or greater	1.13

[40 FR 21939, May 20, 1975)

(2) Process factor.

Process configuration:	Process factor
Less than 4.49	0.73
4.5 to 5.49	0.80
5.5 to 5.99	0.91
6.0 to 6.49	0.99
6.5 to 6.99	1.08
7.0 to 7.49	1.17
7.5 to 7.99	1.28
8.0 to 8.49	1.39
8.5 to 8.99	1.51
9.0 to 9.49	1.65
9.5 or greater	1.72

4. BPT, BATEA, and NSPS limitations within the lube category must be multiplied by the following factors to calculate te maximum for any 1 day and maximum average of daily values for 30 consectutive days.

(1) Size factor

1,000 bbl of feedstock per stream day:	Size Factor
Less than 49.9	0.71
50.0 to 74.9	0.74
75.0 to 99.9	0.81
100.0 to 124.9	0.88
125.0 to 149.9	0.97
150.0 to 174.9	1.05
175.0 to 199.9	1.14
200.0 or greater	1.19

(2) Process factor

Process configuration:	Process Factor
Less than 6.49	0.81
6.5 to 7.49	0.88
7.5 to 7.99	1.00
8.0 to 8.49	1.09
8.5 to 8.99	1.19
9.0 to 9.49	1.29
9.5 to 9.99	1.41
10.0 to 10.49	1.53
10.5 to 10.99	1.67
11.0 to 11.49	1.82
11.5 to 11.99	1.98
12.0 to 12.49	2.15
12.5 to 12.99	2.34
13.0 or greater	2.44

5. BPT, BATEA, AND NSPS limitations within the integrated category must be multiplied by the following factors to calculate the maximum for any 1 day and maximum average of daily values for 30 consecutive days.

(1) Size factor

1,000 bbl of feedstock per stream day:	Size factor
Less than 124.9	0.73
125.0 to 149.9	0.76
150.0 to 174.9	0.83
175.0 to 199.9	0.91
200.0 to 224.9	0.99
225 or greater	1.04

(2) Process factor

Process configuration:	Process factor
Less than 6.49	0.75
6.5 to 7.49	0.82
7.5 to 7.99	0.92
8.0 to 8.49	1.00
8.5 to 8.99	1.10
9.0 to 9.49	1.20
9.5 to 9.99	1.30
10.0 to 10.49	1.42

Process configuration (continued)	Process Factor
11.0 to 11.49..	1.68
11.5 to 11.99..	1.83
12.0 to 12.49..	1.99
12.5 to 12.99..	2.17
13.0 or greater......................................	2.26

6. BAT AND BCT guidelines were not promulgated because there were no known situations in which such standards would be applicable.

7. Proposed guidelines:

SOURCE: Environmental Protection Agency Effluent Guidelines and Standards for Petroleum Refining. 40 Code of Federal Regulations 419, Vol. 39 Federal Register 16560, May 9, 1974 (40 CFR 419; 39 FR 16560, May 9, 1974); Effective May 12, 1974; Amended by 39 FR 32614, September 10, 1974; 40 FR 21939, May 20, 1975; Effective June 19, 1975; 42 FR 15684, March 23, 1977; Amended - Proposed Rules 44 FR 75926 December 21, 1979.

Table III: Canada - Effluent Guidelines for Petroleum Refining

Effluent Limitations (kg/1000 m^3 Feedstock)			
		BPT[1]	
Category	Effluent Characteristics	1[2]	30[3]
Point Source	Oil & Grease	21.5	8.6
	Phenols	2.2	0.9
	Sulfide	1.4	0.3
	Nitrogen as Ammonia	20.7	10.3
	TSS	43.1	20.7

1. Best Practicable Technology
2. Maximum daily amount in kg/1000 m^3 converted from pounds/1000 bbl where 1 bbl = 42 gallons, 3.785×10^{-3} m^3/gal and 0.4563 kg/lb
3. Monthly amount in kg/1000 m^3 converted from pounds/1000 bbl where 1 bbl = gallons, 3.785×10^{-3} m^3/gal and 0.4563 kg/lb.

SOURCE: Canada - Guidelines Respecting toxicity of Liquid Effluents from Petroleum Refineries, 3 November 1973.

Table IV: U.S. EPA Water Quality Criteria for Petroleum Refining

Effluent Characteristic	Status		Limitation Fresh Water	Salt Water	Human Health
BOD5					
TSS			Not to reduce the depth of the compensation point for photosynthesis by more than 10% of seasonal norm.		
COD					
Oil & Grease					
Phenolic Compounds	A[1]		1 ug/ℓ		
	P[2]				3.5 mg/ℓ
Ammonia as N			0.02 mg/ℓ		
Sulfides			2 ug/ℓ	2 ug/ℓ	
Total Chromium					
Hexavalent Chromium	A	100 ug/ℓ		50 ug/ℓ	
Hexavalent Chromium	P	21 ug/ℓ	1,260 ug/ℓ	50 ug/ℓ	
pH		6.5 - 9.0	6.5 - 8.5	5-9	

[1]Approved

[2]Approved

SOURCE: Environmental Protection Agency. 1976. Quality Criteria for Water Washington, D.C. 256p.

45 FR 79319, November 28, 1980.

Table V: Japan - National Effluent Guidelines

Category	Effluent Characteristics	Effluent Limitations (mg/ℓ) BPT[1]
Human Health	Cd	0.1
	Cyanide	1.0
	Organic phosphorous	1.0
	Pb	1.0
	Hexavalent Chromium	0.5
	As	0.5
	Hg	0.005
	Alkyl Hg	Not detectable[2]
	PCB	0.003
Preservation of Living Environment[3]	pH	5.0 - 9.0
	BOD, COD	160
	TSS	200
	Phenols	5
	Cu	3
	Zn	5
	Dissolved Fe	10
	Dissolved Mn	10
	Cr	2
	Fluorine	15

1. Best Practicable Technology

2. Not detectable means that the substance is below the level detectable by the method designated by the Director General of the Environment Agency.

3. Effluent standards in this table are applied to the effluents from industrial plants or other business places whose volume of effluents per day is 50 m^3.

SOURCE: Environmental Quality Standards Regarding Water Pollution. Environmental Agency Notification No. 59, December 28, 1971. amended: Environmental Agency Notification No. 63 of 1974.

Table VI: Japan Water Quality Standards

Category	Effluent Characteristics	Effluent Limitations (mg/ℓ) BPT[1]
Coastal Waters		
a. Fishery, class 1: bathing, conservation of natural environment and uses listed b-c	pH COD DO no. of coliform groups	7.8-8.3 2 or less 7.5 or more 1,000 MPN/100 ml
b. Fishery, class 2: industrial water and uses listed in c	pH COD DO	7.8-8.3 3 or less 5 or more
c. Conservation of the environment	pH COD DO	7.0-8.3 8 or less 2 or more

1. Best Practicable Technology based upon the daily average value

2. Definition of terms used in this category

   a. Conservation of natural environment: Conservation of scenic spots and other natural resources.
   b. Water supply, class 1: Water treated by simple cleaning operations, such as filtration.
   c. Water supply, class 2: Water treated by normal cleaning operations, such as sedimentation and filtration.
   d. Water supply, class 3: Water treated through a highly sophisticated cleaning operation including pretreatment.
   e. Fishery, class 1: For aquatic life such as trout and bull trout inhabiting oligosaprobic water, and those of fishery class 2 and class 3.
   f. Fishery, class 2: For aquatic life, such as fish of the salmon family and sweetfish inhabiting oligosaprobic water and those of fishery class3.
   g. Fishery, class 3: For aquatic life such as carp and silver carp inhabiting -mesosaprobic water.
   h. Industrial water, class 1: Water given normal cleaning treatment such as sedimentation.
   i. Industrial water, class 2: Water given sophisticated treatment by chemicals.
   j. Industrial water, class 3: Water given special cleaning treatment.
   k. Conservation of environment: Up to the limits at which no unpleasantness is caused to people in their daily lives (including a walk by the riverside, etc.).

SOURCE: Environmental Quality Standards Regarding Water Pollution. Environmental Agency Notification No. 59, December 28, 1971. Amended: Environmental Agency Notification No. 63 of 1974.

Table VII: Kuwait - Marine Water Quality Criteria

Effluent Characteristic	Effluent limitations (mg/ℓ) DEV[1]	THV[2]
pH	8.0	5.5-9.0
DO	5.4	2.0
COD	2.0	4.0
BOD	2.0	4.0
Total Hydrocarbons	Note detectable	0.5
Phenols	0.05	0.10
Sulfides	0.005	0.01
N as Ammonia	0.02	0.20-0.50
Oxidized nitrogen	0.40	0.80
Total nitrogen	0.50	1.30
Inorganic P	0.001	0.02
Cyanide	Not detectable	0.01
Alkyl Hg	Not detectable	0.0001
Total Hg	Not detectable	0.0001
As	0.01	0.05
Cd	0.001-0.01	0.03
Pb	0.01	0.05
Cr	0.05	0.10
Cu	0.001-0.01	0.05
Zn	0.001-0.05	0.10
Fe	0.05	0.30
Mn	0.02	0.10
Ni	0.002	0.10

1. Desirable Environmental Value
2. Threshold Hazard Value

Table VIII: Ambient Quality Criteria for Air Pollutants

Substance and country	Long-term standard[1] mg/m³	Long-term standard[1] ppm	Short-term standard[1] Averaging Time (hours)	Short-term standard[1] mg/m³	Short-term standard[1] ppm	Averaging Time (Minutes)	Notes
Carbon monoxide							
Argentina	11.5	10.0*	8	57.7	50.0*	60	
Bulgaria, East Germany, Hungary, USSR, Yugoslavia	1.0*	0.9	24	3.0*	2.7	30	
Canada - Desirable level	6.0*	5.0*	8	15.0*	13.0*	60	Air Quality objectives[2]
- Acceptable level	15.0*	13.0*	8	35.0*	30.0*	60	Air quality objectives
Czechoslovakia	1.0*	0.9	24	6.0*	5.4	30	
Finland	10.0*	9.0*	8	40.0*	35.0*	60	
Hungary, Romania	2.0*	1.8	24	6.0*	5.4	30	
Israel	11.5	10.0*	8	35.0	30.0*	30	
Italy	23.0	20.0*	8	57.7	50.0*	30	
Japan	11.5	10.0*	24	--	--	--	Average of hourly means
	23.0	20.0*	8	--	--	--	
Poland	0.5*	0.45	24	3.0*	2.7	20	For protected areas
Spain	15.0*	13.0	8	45.0*	39.0	30	Proposed standard
USA, West Germany	10.0*	8.6	8	40.0*	35.0	60	
Hydrogen sulfide							
Bulgaria, Czechoslovakia, Hungary, USSR, Yugoslavia	0.008*	0.005	24	0.008*	0.005	30	
East Germany	0.008*	0.005	24	0.015*	0.01	30	
Finland	0.05*	0.03	24	0.15*	0.1	30	
Hungary	0.15*	0.1	24	0.3*	0.2	30	
Israel	0.045	0.03*	24	0.15	0.1*	30	
Italy	0.04	0.03*	24	0.1	0.07*	30	Once in 8 h
Poland	0.02*	0.013	24	0.06*	0.04	20	For protected areas
	0.008*	0.005	24	0.008*	0.005	20	Specially protected areas

Table VIII: Ambient Quality Criteria for Air Pollutants - continued

Substance and country	Long-term standard[1] mg/m3	ppm	Averaging Time (hours)	Short-term standard[1] mg/m3	ppm	Averaging Time (Minutes)	Notes
Ozone							
Israel	0.1	0.05*	24	0.2	0.1	30	Tentative
Sulfur dioxide							
Argentina	0.07*	0.03*	30 days	--	--	--	
Belgium, Spain	0.15*	0.06*	1 yr	--	--	--	Proposed for Spain
Bulgaria, USSR	0.05*	0.02	24	0.5*	0.2	30	
Canada - Acceptable level	0.06*	0.02*	1 yr	--	--	--	Air Quality objectives
- Acceptable level	0.3*	0.11*	24	0.9*	0.34*	60	Air Quality objectives
- Desirable level	0.03*	0.01*	1 yr	--	--	--	Air Quality objectives
- Desirable level	0.15*	0.06*	24	0.45*	0.17*	60	Air Quality objectives
Colombia	0.07*	0.03	1 yr	--	--	--	Reference level
Czechoslovakia, East Germany, Hungrary, West Germany, Yugoslavia	0.15*	0.06	24	0.5*	0.2	30	
Finland	0.25*	0.1	24	0.72*	0.28	30	
	0.18*	0.07	1 yr	--	--	--	
France	1.0*	0.38	24	--	--	--	
Hungary	0.5*	0.2	24	1.0*	0.38	30	
Israel	0.26	0.1*	24	0.75	0.3*	30	
Italy	0.38	0.15*	24	0.75	0.3*	30	Once in 8 h
Japan	0.1	0.04*	24	0.26	0.1*	60	Average of hourly means for 24-h value
Netherlands	0.075*	0.03	24	--	--	--	
	0.25*	0.1	24	--	--	--	
	0.35*	0.13	24	--	--	--	
	0.125*	0.05	24	--	--	--	
	0.275*	0.1	24	--	--	--	

Table VIII: Ambient Quality Criteria for Air Pollutants - continued

	Long-term standard[1]			Short-term standard[1]			
Substance and country	mg/m^3	ppm	Averaging Time (hours)	mg/m^3	ppm	Averaging Time (Minutes)	Notes
Sulfur dioxide - continued							
Netherlands, Turkey	0.15*	0.06	24	--	--	--	
Poland	0.35*	0.13	24	0.9*	0.35	20	Protected area
	0.075*	0.03	24	0.25*	0.1	20	Specially protected areas
Romania	0.25*	0.1	24	0.75*	0.3	20	
Spain	0.4*	0.15	24	0.8*	0.3	30	Proposed
	0.256*	0.1	30 days	--	--	--	Proposed
Sweden	0.25*	0.1*	24	0.625*	0.25*	30	Guideline
	0.125*	0.05*	30 days	--	--	--	Guideline
Switzerland	0.75*	0.3	24	1.25*	0.5	30	Winter Guideline
Switzerland, West Germany	0.5*	0.2	24	0.75*	0.3	30	
Turkey	0.30*	0.12	24	--	--	--	Recommended in Industrial area
United States	0.08*	0.03	1 yr	--	--	--	Primary standard
	0.365*	0.14	24	--	--	--	Primary standard
	1.3*	0.5	3	--	--	--	Secondary standard
West Germany	0.4*	0.15	1/2	0.75*	0.3	30	
Hydrocarbons (total)							
Israel	2.0	3.0*	24	5.0	7.5*	30	Tentative
Italy	26.6	40.0*	24	53.3	80.0*	30	As hexane; once in 8 h
United States	0.16*	0.24*	3	--	--	--	Not to be exceeded more than once a year

Table VIII: Ambient Quality Criteria for Air Pollutants - continued

Substance and country	Long-term standard[1] mg/m^3	ppm	Averaging Time (hours)	Short-term standard[1] mg/m^3	ppm	Averaging Time (Minutes)	Notes
Suspended particulates							
Argentina	0.15*	--	30 days	--	--	--	
Bulgaria, Czechoslovakia, East Germany, Finland, Romania, USSR	0.15*	--	24	0.5*	--	30	
Canada - Acceptable level	0.07*	--	1 yr	--	--	--	Air quality objective
- Acceptable level	0.12*	--	24	--	--	--	Air quality objective
Canada (Desirable level), United States	0.06*	--	1 yr	--	--	--	Secondary standard in United States
Colombia	0.1*	--	24	--	--	--	Reference level
Hungary	0.2*	--	24	--	--	--	
Hungary, Turkey, United States	0.15*	--	24	--	--	--	Secondary standard in United States
Israel	0.2*	--	24	--	--	--	
Israel, United States	0.075*	--	1 yr	--	--	--	Primary standard in United States
Italy	0.3*	--	24	0.75*	--	120	Once in 8 h
Japan	0.1*	--	24	0.2*	--	60	Average of hourly means
Poland	0.2*	--	24	0.6*	--	20	<20 µm
	0.075*	--	24	0.2*	--	20	<20 µm
Spain	0.13*	--	1 yr	--	--	--	Proposed
	0.202*	--	30 days	--	--	--	Proposed
	0.3*	--	24	0.6*	--	30	Proposed
Sweden	--	-	--	0.1*	--	60	
United States	0.26*	--	24	--	--	--	Primary standard
West Germany	--	--	--	0.48*	--	30	
	0.1*	--	1/2	0.3*	--	30	

[1] Concentrations with asterisks represent the standards listed in promulgated regulations; those without asterisks are approximate conversions.

[2] See Newill 1977 for more detailed information.

SOURCE: Newill, V.A. 1977. Air Quality Standards. p. 445-504. In: A.C. Stern (ed.) Air Pollution, Third edition, Vol. 4 Air Quality Management. Academic Press, New York, N.Y.