Guidelines for an Environmental Review & Management Proposal

THE CHITTERING ALUMINA PROJECT
PACMINEX PTY LTD

Department Environmental Protection

GUIDELINES FOR AN ENVIRONMENTAL REVIEW AND MANAGEMENT PROPOSAL FOR THE PACMINEX CHITTERING ALUMINA PROJECT

TO BE PREPARED BY PACMINEX PTY LTD

GUIDELINES PREPARED BY -
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WESTERN AUSTRALIA
JANUARY 1975

INTRODUCTION

The Environmental Review and Management Proposal should not be simply a list of characteristics of the existing environment and the effects which the development proposal will have, but rather should guide the reader through the processes by which the decision to proceed with the proposal was made. In addition to proposed safeguards to protect the environment, the document should show an awareness of the need for both:

i) the environmental monitoring, management and on-going research with respect to the immediate proposal; and

ii) the overall management and interaction of the various land uses to which the region is subject.

The main text of the report should be a readable document containing a minimum of technical data, the discussion of the details of decisions and proposals being of greater importance. All technical data however should be lodged in an appendix.

Section 1 requires a detailed discussion of the aspects listed in terms of the total project and its regional, State and, where applicable, national objectives and implications.

Section 2 is confined to the mining operation, though interactions with the refining side may require comment. Similarly Section 3 pertains to the refining operations while Section 4 is provided to allow for the inclusion of all technical back-up data on which the rest of the Environmental Review and Management Proposal is based.

SECTION 1 THE TOTAL PROJECT

1.1 SUMMARY

This section of the report should form a self-contained document summarising the proposal and the conclusions reached as a consequence of the environmental study. It should answer, in summary form, the questions:

i) Why is the proposal desired?

ii) What environmental advantages and disadvantages will the project have?

iii) What environmental management and safeguards will be instituted to minimise the disadvantages?

iv) What irreversible effects cannot be safeguarded?

1.1.1 Report Structure

Outline the report structure as a guide to the reader to indicate the flow of the decision-making process through the report.

1.1.2 Parties Responsible

List the members of the consortium together with brief details of their structure, expertise and experience in environmental management.

1.1.3 Authorities Consulted

List the authorities consulted in preparing the document.

1.1.4 The Proposal

Give a short description of the proposal including all ancillary aspects such as transport, services, housing, etc.

1.1.5 Environmental Effects

Briefly summarise all likely environmental effects of the proposal, both positive and negative (ie advantageous and

disadvantageous respectively).

1.1.6 Environmental Management Programme

Give a brief summary of the suggested methods of amelioration of the adverse environmental effects. This section should also include a summary of the proposed environmental monitoring, research and management programmes to be instituted by the Company together with a brief outline of the current State environmental management policies and operations in the Darling Scarp area. This should include an understanding of State environmental requirements under the Muchea Agreement and an awareness of current research being carried out into the effects of bauxite mining in the Darling Scarp (eg Hunt Steering Committee etc).

1.2 PROJECT DESCRIPTION

This section should be a sufficiently detailed description of the project to give an understanding of the possible interactions between the mining and refining processes on the one hand, and the physical and human environment on the other.

1.2.1 Mining

This should include such things as a description of the mining methodology and a plan showing the likely time-area relationships of the deposits to be mined. It should also include details of land tenure and mineral entitlement within the Pacminex lease as well as similar details of Pacminex's interests outside the lease area.

1.2.2 Refining

This should include a description of the refining plant and methodology together with a description and plan showing the time-area relationship of the disposal of all waste material.

1.2.3 General

This section should cover any general interactions between the mining and refining not adequately covered in 1.2.1 and 1.2.2 (eg, construction and/or upgrading of transport facilities).

1.3 PROJECT JUSTIFICATION

Under the following headings the reasons for proceeding with the project should be discussed, in decreasing detail, in terms of the Company, the region, the State and the Nation. The discussion should show appreciation of the broad national issues as well as the more specific company objectives. This section is not seen as a benefit/cost analysis, but rather as a brief outline of economic and other considerations and constraints leading to the choice of the project at this particular time and place. It should indicate that the broader implications are appreciated (for example, the development of the Amax deposits at Mitchell Plateau might achieve the same objectives for the State and the Nation, without the deleterious effects on the Perth and adjacent environment, but would do nothing for either the region or the Company).

1.3.1 Objectives

Discuss the objectives sought by the proposal. This should include both the major objectives (economic gain to the Company, the State, etc) and the "spin-off" objectives such as employment, decentralisation, transport facilities, enhancement of the environment, etc.

1.3.2 Rationale

Discuss the questions:

i) why proceed at this time,
ii) in this place, and
iii) in this chosen way?

Included here should be a discussion of national and international supply and demand considerations.

1.3.3 Implications

Discuss the implications of proceeding and not proceeding.

SECTION 2 THE MINING OPERATION

For the purposes of definition this section should cover all aspects of the development proposal involved with the removal of bauxite from the mine areas and its translocation to the refinery. This includes the development of the mine site, any and all construction in the mine area, the transport and communication facilities between the mine sites and the refinery, and the effects of all these aspects on the total physical and human environment.

2.1 ALTERNATIVES

2.1.1 Areas to be Mined

Discuss the areas to be mined both within and outside the Company's lease area. This should include a discussion of the time-area relationship of mining these areas together with both economic and other reasons, including environmental aspects, as to the priority ratings of these areas.

2.2.2 Bauxitic Areas Not to be Mined

Discuss the areas with bauxite potential, as defined by the Company's exploration programme, which are not likely to be mined. This should include a brief summary of the reasons, economic, environmental and otherwise, as to why these areas will not be mined.

2.2 EXISTING ENVIRONMENT

For each of the areas to be mined describe and discuss the existing environment under the following headings.

2.2.1 The Physical Environment

The following physical aspects of the environment should be described. With reference to 2.2.1(v) to 2.2.1(vii), particular attention should be paid to any reserves in the area and their importance both now and in the future.

i) Land Form: Discuss the topographic features of the areas.

ii) Geology: Discuss the geology of the areas in general terms including reference to bauxite, soil types, soil profiles, erosional characteristics, etc.

iii) Water: Discuss the drainage systems, surface water and hydrogeology of the areas including salinity, turbidity, etc of wetlands, streams and ground water.

iv) Meteorology: Discuss the meteorology of the areas with particular reference to factors affecting the mining operation.

v) Flora: Discuss the vegetation of the area with particular reference to any rare species. The discussion should include consideration of the problem of *Phytophthora cinnamomi* in the jarrah forest region of the Darling Scarp.

vi) Fauna: Discuss the native fauna of the area with particular reference to any rare species.

vii) Ecosystem: Discuss the interrelationship of the above aspects not already covered.

2.2.2 The Human Environment

In this section the Company should discuss the relevance of the high proportion of developed (cleared), privately owned land in and adjacent to the areas to be mined. Certain areas (eg the Avon and Brockman valleys) are extremely important for both passive (scenic drives, picnics, etc) and active (bushwalking, canoeing, etc) recreational pursuits. Particular emphasis should be placed on the importance now, and in the future, of the area as a recreational resource for the metropolitan region.

i) Land Utilisation: Discuss the present land use situation including industry, primary production (farming, forestry, bee-keeping, viticulture) water catchment, recreation, education projects (eg Kearney College) etc.

ii) Population Distribution and Structure: Discuss the existing population in and adjacent to the mine areas.

iii) Communications and Transport: Discuss the existing communications and transport systems and their usage.

2.3 ENVIRONMENTAL MODIFICATION

Discuss for each of the areas to be mined both the positive and negative effects the mining proposal will have on the existing environment and, where applicable, the constraints imposed on the mining operations by the environment. These aspects should be discussed under the following headings.

2.3.1 The Physical Environment

i) Land Form: Discuss the modifications which will be made to the land form (eg removal of hill tops, creation of pits, etc).

ii) Geology: Discuss the effects on the geology of the area with particular reference to changes in both soil profiles and erosional characteristics.

iii) Water: Discuss the effects of the proposal on drainage systems and surface and ground water quality, quantity, etc.

iv) Meteorology: Discuss the effects in terms of the meteorology of the area.

v) Flora: Discuss the effects in terms of the vegetation of the areas to be mined (eg removal of forest and rare species and the possible spread of *Phytophthora cinnamomi*, etc).

vi) Fauna: Discuss the effects in terms of the native fauna of the areas (eg destruction of habitat, dispersal of populations and the breakdown of territories, etc).

vii) Ecosystem: Discuss the effects of the mining proposal in terms of the interrelationship of the above aspects not already covered.

2.3.2 The Human Environment

i) Land Utilisation: Discuss the effects in terms of the present land utilisation.

ii) Population Distribution and Structure: Discuss the effects on the present population in and around the mining areas. Consider such aspects as shift work, male-female ratios, age distribution, employment opportunities, effect on non-company persons residing and utilising the area, etc.

iii) Communications and Transport: Discuss the effects of the mining and ancillary operations on the existing transport and communications systems.

iv) Health: Discuss the effects of the mining and ancillary operations on human health and well being (eg dust, noise, aesthetics, etc).

2.3.3 Resource Commitment: Discuss the effects which mining will have in terms of constraints on the future utilisation of the resources of the areas to be mined. In doing so the following questions should be answered.

i) Land: What alternative future uses are available for the mined areas?

ii) Natural Resources: What irreversible use is made of animal, vegetable and mineral (including water) resources, and what alternative uses are then available?

iii) Human Use and Appreciation: What irreversible commitment is made of areas of current human use and appreciation; such as tourism, scenic drives, bushwalking trails, etc; and what alternative uses remain?

In Pacminex's case, particular emphasis should be placed on both the proximity of the area to Perth, and the aesthetic effects of mining which will be readily visible from the many major and link roads through the area. It is well recognised that many of these roads are heavily used for recreational purposes such as scenic drives, etc.

2.4 REVIEW OF BENEFITS AND ADVERSE EFFECTS

Briefly review the benefits and adverse effects of mining in each of the areas, taking into account both environmental and non-environmental benefits and costs.

2.5 ENVIRONMENTAL MANAGEMENT PROPOSALS

Under the terms of the Alumina Refinery (Muchea) Agreement Act, 1972, the Company is obliged to abide by all the relevant clauses and schedules contained in that Act. Aware of this point, and of all other existing State Legislation which is not contrary to the Muchea Agreement, the Company should discuss in detail the environmental management proposals which it will adopt in respect of the points considered in Section 2.3. These proposals should highlight the safeguards and on-going research which will be implemented, as well as the way in which the Company sees their environmental management proposal integrating with the State's overall management and research programme for the whole Darling Range Region.

For its part the Department of Environmental Protection undertakes to keep the Company informed with regard to significant and future development of the State's environmental management programme and policy for the Darling Range Region.

SECTION 3 THE REFINING OPERATION

For the purposes of definition this section should cover all aspects of the proposal involved with the storage of raw bauxite at the refinery site, the refining of bauxite and the disposal of all waste products, the transport and communication systems involved with the translocation of the refined alumina to the port site, and the storage and load-out facilities at the port.

3.1 ALTERNATIVES

Discuss the alternative refining options including the various refining processes, the export of raw bauxite versus refined alumina, inter-company refining possibilities, etc. The discussion should also include allowance and considerations for the future expansion of operations and the development of ancillary industry.

3.2 EXISTING ENVIRONMENT

For the Muchea site and ancillary facilities, including storage and the load-out at Kwinana, discuss the existing environment with particular reference to the refining operation, waste disposal and the associated transport and service requirements.

3.2.1 The Physical Environment

i) Land Form: Discuss the topographic features of all areas involved.

ii) Geology: Discuss the geology of the areas with particular reference to the requirements of both waste disposal and the revegetation of red mud ponds.

iii) Water: Discuss the drainage systems, surface water and the hydrogeology of the areas with particular reference to red mud and other waste disposal, water requirements, pipelines, power lines, road and rail links etc.

iv) Meteorology: Discuss the meteorology of the areas with particular reference to air pollution factors such as temperature inversions and humidity in the vicinity of the refinery.

v) Flora: Discuss the vegetation of the area with particular reference to any rare species and the importance of State Forest Number 65.

vi) Fauna: Discuss the fauna of the area with particular reference to any rare species.

vii) Ecosystem: Discuss the above aspects of the areas with particular reference to their interaction with the refinery and ancillary operations.

3.2.2 The Human Environment

i) Land Utilisation: Discuss the present land use situation in all areas concerned including industry, primary production, recreation and transport, communication and service routes.

ii) Population Distribution and Structure: Discuss the present population structure in all areas concerned and include such factors as employment opportunities, recreational facilities, etc.

iii) Communications and Transport: Discuss the present transport and communication systems and their current usage.

3.3 ENVIRONMENTAL MODIFICATION

Discuss the positive and negative effects which the refining operation, the disposal of waste and the associated developments will have on the existing environment and, where applicable, describe the constraints imposed on the refining operation by the environment. These aspects should be discussed under the following headings.

3.3.1 The Physical Environment

i) Land Form: Discuss modifications which will be made to the land form (eg site levelling, rail cuttings, red mud disposal sites, etc).

ii) Geology: Discuss the geology of the areas with particular reference to both red mud disposal areas and buffer zones.

iii) Water: Discuss the effects of the refining operation, and its associated constructions, in terms of surface and underground water supply and demand, and the potential pollution of both these water systems by waste disposal.

iv) Meteorology: Discuss the effects of local meteorological conditions on the air pollution aspects of the refinery operations.

v) Flora: Discuss the effects of the refinery and waste disposal operations in terms of the vegetation of the areas.

vi) Fauna: Discuss the effects of the refinery and waste disposal operations on the fauna of the areas. Particular reference should be made to the likely problem of water fowl settling on the highly caustic red mud ponds.

vii) Ecosystems: Discuss the effects of the refining and waste disposal operations in terms of the interrelationships of the above aspects not already covered.

3.3.2 The Human Environment

i) Land Utilisation: Discuss the effects of the refinery operations, waste disposal methods, load-out facilities and transport systems in terms of the present land uses in the areas concerned.

ii) Population Distribution and Structure: Discuss the effect of the added work force on the social structure of the population in all areas concerned (eg shift work, male/female ratios, age distribution, employment opportunities, effect on external population, etc).

iii) Communications and Transport: Discuss the effects of various transport needs on existing transport facilities (eg public use of Company roads and vice versa, commuter transport facilities, etc).

iv) Health: Discuss the health aspects of effluent disposal to the air, water and land including offensive odours, noise and aesthetics of the refinery operation, waste disposal, and the transport and load-out facilities.

3.3.3 Resource Commitment

Discuss the effects which the refining operation and its associated developments will have in terms of constraints on future use of the resources of the area. In doing so the following questions should be answered.

i) Land: What land areas are committed by the refinery and waste disposal operations, and what future alternative uses are available for the land?

ii) Natural Resources: What irreversible use is made of all animal, vegetable and mineral (including water) resources, and what alternative uses of these are then available?

iii) Human Use and Appreciation: What irreversible use is made of areas of human use and appreciation; such as tourism, wildflowers, scenic attractions, standing water, etc; and what alternative uses then remain?

3.4 REVIEW OF BENEFITS AND ADVERSE EFFECTS

In view of the foregoing discussion and analyses of the refining operations, briefly review their benefits and adverse effects taking into account both environmental and non-environmental benefits and costs.

3.5 ENVIRONMENTAL MANAGEMENT PROPOSALS

Aware of the Company's obligations under their Agreement Act, and under all State legislation which is not contrary to the Muchea Agreement; the Company should discuss in detail the environmental management proposals which it will adopt in respect of the points considered in Section 3.3. These proposals should highlight the safeguards and on-going research which will be implemented by the Company.

SECTION 4 APPENDICES

Attach here all data, figures, tables and plans, such as detailed mining and refining specifications, time-area plans, lists of flora and fauna, schedules of research programmes, details of costing, flow charts, etc.

It would greatly assist the reader if the Company, in the preparation of their report, would provide a small scale, fold-out frontispiece plan showing the layout of the whole development proposal (eg the mineral lease, the areas to be mined, the refinery and waste disposal locations, the transport routes and storage facilities and the location of the load-out at the port). This plan would enable any reader, not familiar with the proposal, to locate various aspects of the project at any stage during his reading of the report.

A GENERALISED ENVIRONMENTAL MANAGEMENT PROGRAMME FOR A BAUXITE MINING AND REFINING OPERATION IN THE DARLING RANGE REGION OF WESTERN AUSTRALIA

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WESTERN AUSTRALIA
JANUARY 1975

INTRODUCTION

The following document points out the likely environmental issues associated with a bauxite mining-refining operation in the Darling Range Region of Western Australia. Its aim is, in summary form, to outline all aspects of the operation which will or may impinge on the environment, and which will therefore require continual management, monitoring and/or research.

For the purposes of convenience and lucidity the likely environmental issues have been divided into the following groups; that is those associated with:

1. the Mine Area,
2. the Refinery Area,
3. the Red Mud Disposal Ponds,
4. the Load-Out at the chosen Port, and
5. the Communications and transport links between these sites

Under current State policy, bauxite development companies must enter into an Agreement Act with the State of Western Australia and under their respective Acts, the Companies are obliged to abide by all existing and future legislation of the State. Where relevant such legislation is noted in the following, summarised environmental management programme.

In many situations the Company is required to liaise with State Departments who are responsible for administering aspects of the environment (eg Fisheries and Wildlife for the protection of fauna or the Forests Department in relation to the administration of State Forests and the Flora Protection Act). Similarly with regard to their own environmental research and monitoring, the Company must, at all times

continued:

make their data and plans available to the other departments and organisations involved in associated research in the Darling Range Region.

In both instances above, the Company should maintain such communication and liaison through the Department of Environmental Protection.

GENERAL MANAGEMENT PROGRAMME

1. THE MINE AREA

1.1 WATER (Covered by Rights in Water and Irrigation Act, 1914, and its Amending Bill).

1.1.1 Water Quantity

The removal of surface vegetation promotes increased surface run-off which can cause problems of:

i) Soil erosion
ii) Siltation
iii) Turbidity

Adequate provision, including:

i) deep ripping of mined areas,
ii) contour ploughing of mined areas,
iii) construction of water collecting, down-slope bunds at mined areas,
iv) construction of silt-settling ponds at mined areas,
v) construction of drainage channels to handle excess surface run-off from mined areas. These channels should lead into settling ponds to allow the silt fraction to settle,
vi) construction of drainage channels along mine roads to control and direct excess surface run-off,
vii) the establishment of vegetative ground cover on all mined areas as soon as possible after the completion of mining (see Section 1.2),

must be taken by the Company to ensure the minimum environmental damage from increased surface run-off including the use of the best accepted methods of control and/or amelioration of such problems at that specific point of time that these areas are being mined.

1.1.2 Water Quality

i) Turbidity and Siltation: Removal of surface vegetation promotes increased run-off which causes the problems of turbidity and siltation which can change the quality of the water running into the natural drainage systems. Methods for control and amelioration are covered under Section 1.1.1.

ii) Salinity: Removal of vegetation also lowers the evapotranspirative water loss which causes an increase in the level of the water table. It is thought that this may cause salinity problems in the water catchment areas by increasing the total dissolved salt content of the ground water. Adequate provision must be made by the Company for the rapid establishment of vegetative cover under the controls stipulated in Section 1.2.

iii) Chemical: The spillage of lubricating oil, liquid fuels and other such chemicals used by equipment in the mine area is a likely cause of water pollution. Adequate provision must be made by the Company to restrict and control such causes for the contamination of surface and ground waters.

iv) Biological: Adequate provision must be made by the Company to ensure that the biological contamination of surface and ground water systems does not occur through such means as sewerage disposal etc.

v) General: In all areas of water quality and quantity management, the Company must cooperate and coordinate with those organisations currently studying these problems (eg Hunt Steering Committee and CSIRO).

1.2 FOREST MANAGEMENT AND REAFFORESTATION (Covered by the Forest Act 1918 - 1969)

1.2.1 Reafforestation

As mentioned in Section 1.1 the removal of trees promotes environmental problems with respect to water quantity and quality. The best accepted method for amelioration of these problems is the rapid reafforestation of mined areas. Where the mine areas are on State forest the Company must reafforest the mined areas as quickly as possible after mining in accordance with the terms of the Agreement and in doing so must at all times liaise and cooperate with the Forests Department.

1.2.2 Forest Management

Increased access by equipment and personnel for the purposes of mining increases the risk of the spread of *Phytophthora*, which in the long term will cause a reduction in evapo-transpirative water loss thereby increasing the ground water salinity. The Company must at all times follow the advice of the Forests Department with respect to the best accepted methods of forest hygiene to limit the spread of *Phtophthora*.

1.2.3 Bee Keepers

Certain areas of the forest are used for the commercial production of honey. The Company must cooperate with the Department of Agriculture to ensure an equitable management of the clash between these two land-use objectives.

1.2.4 Research Associated with Reafforestation

The problem of rapid reafforestation to ensure minimum contamination of ground water by salinity increase, is one

that requires continual research. Specific areas where research is required are:

i) the study of the best types and use of fertilisers,

ii) the study of the best species of trees to be replanted in order to give the best control of the potential salinity problem. The re-establishment of commercial timber species should not necessarily be the prime objective,

iii) the study of the best methods of removing and spreading the top soil. Stock piling over long periods is thought to kill a high proportion of the natural seed content which is valuable for the rapid establishment of ground cover to minimise surface erosion,

iv) the study of mulching techniques in order that vegetative material, from clearing for the purposes of mining, may be returned to the top soil on the completion of mining to provide required organic matter for the rapid establishment of ground cover and tree seedlings,

v) the study of the best methods to rapidly establish a natural ground cover and understorey.

The Company should initiate its own research programme to study these, and other associated problems. At all times they should liaise and coordinate their studies with those being carried out by the Forests Department, CSIRO, and other involved organisations.

1.3 REHABILITATION AND REVEGETATION OF PRIVATE LAND

1.3.1 Written Agreement with the Freeholder

Where the land is private land the Company must enter into a written agreement with the proprietor of the land for the purposes of providing for the adequate rehabilitation and revegetation of those areas disturbed in any way by mining. In all instances, including where the private land is owned by the developing Company itself, the methods of rehabilitation

and revegetation described in the agreement with the free-holder must be approved by the Minister administering the Agreement Act between the State and the Company.

1.3.2 Methods of Rehabilitation and/or Revegetation

In rehabilitating, restoring or revegetating the areas disturbed by mining the Company will:

i) prevent damage by soil erosion, resulting from increased surface run-off, by means of contour ploughing, deep ripping of mined areas; the construction of diversion channels, settling ponds and retaining walls; the rapid establishment of a suitable vegetative cover over the mined area, etc;

ii) minimise visual degradation of the natural environment both during and after the mining operations. This would include where practical the planting of buffer zones of trees to screen the mined areas from adjacent public roads and areas of human habitation and utilisation;

iii) minimise the likely increase in ground water salinity resulting from the clearing of forested areas of private land. Where the Company is the owner of the land it shall, where practical, attempt to reafforest some areas, no matter how small, for the purposes of restoring as much as possible the status quo with regard to evapo-transpirative water loss. Such water loss from deep-rooted tree species is much greater than from shallow-rooted cereal crops and pastures, and is consequently more effective in maintaining the hydrological balance of the ground water system.

1.4 STRUCTURAL AND ENVIRONMENTAL DAMAGE FROM BLASTING

(Partially covered by the Mines Regulation Act, 1946.)

1.4.1 Ground Vibrations

While it would appear that ground vibrations are unlikely to cause structural damage either to the natural or human environment, adequate provision must be taken by the Company

to ensure that no damage occurs. To ensure this the Company should carry out their own seismic monitoring programme in accordance with techniques recommended by the Mines Department.

1.4.2 Air Blast

While the risk of damage to the human and natural environment from air blast appears slight, the Company should initiate their own monitoring programme to ascertain at what levels of air over-pressure the first signs of structural damage (eg probably the breakage of glass windows) are evident.

1.4.3 Fly Rock

Adequate provision must be made by the Company to ensure no structural damage or personal injury to non-Company personnel is caused by fly-rock. This would best be done by leaving adequate buffer zones between areas of blasting and areas where such damage or injury may be incurred.

1.4.4 Compensation

In all instances covered by 1.4.1 to 1.4.3, adequate provision must be made by the Company for the compensation of all persons adversely affected by those effects.

1.5 NOISE (Partially covered by the Noise Abatement Act, 1972 and the Traffic Act, 1919)

Where aspects of the following noise problems (eg blasting) are not covered under the Noise Abatement Act, adequate provision must be made by the Company to negotiate with and compensate persons adversely affected by such noise.

The following are likely sources of noise which the Company should undertake to minimise:

i) Blasting

ii) Crushing Plant

iii) Equipment.

In the instance of 1.5 (ii) and 1.5 (iii) the Company should undertake to fit mufflers on all earth moving equipment and to monitor all equipment and fixed plant noise to determine the maximum noise levels which are acceptable to non Company personnel utilising the areas adjacent to the mine areas.

1.6 EMISSIONS TO THE ATMOSPHERE, (Covered by the Clean Air Act, 1964 and the Traffic Act 1919).

Likely sources of emission to the atmosphere are:

i) Dust - a) from blasting

b) from earth moving equipment

ii) Exhaust emissions from vehicles and fixed plant.

With respect to 1.6 (i) (a) and (b) the Company must investigate the best means of dust suppression. At the present stage this would include the adequate watering of dirt roads to minimise dust from this source. On this matter the Company should also maintain close liaison with the Local Authorities.

With respect to 1.6 (ii) at present national standards for all forms of vehicle emission are not currently established. However, the Company will endeavour to minimize such emissions and, upon the introduction of quantified standards, the Company must make provisions for these standards to be met.

1.7 FLORA (Covered by the Native Flora Protection Act, 1935)
The Company should conform with existing statutory requirements on this point and where possible liaise andcooperate with the Department of Fisheries and Wildlife and the Forests Department on all aspects.

1.8 FAUNA (Covered by the Fauna Conservation Act, 1950)

As for 1.7 above and where possible the Company should liaise and cooperate with the Department of Fisheries and Wildlife and the Western Australian Wildlife Authority, on all aspects.

The Darling Scarp region is extensively used for weekend recreation by people residing in the metropolitan area. With this in mind the Company will at all times provide for the maximum protection of the native fauna and flora. Where mining is to be in forested areas of Crown land, the Company will liaise with, and follow the advice of, the State Department administering that land, eg the Forests Department. Disturbance of the natural environment can have deleterious effects on native fauna. For example roads can act as "barriers" which may disrupt and interfere with the territorial behaviour and social structure of indigenous species of mammals. Where possible, and with the approval of the Forests Department, the Company should endeavour to direct their mine roads around areas of natural forest which are not to be mined.

Where the mining is to be in forested areas on private land, and where the proprietor of that land is agreeable, the Company should:

a) endeavour where practical to reafforest the mined areas as soon as possible after mining; and

b) disturb as little as possible of those forested areas not to be mined (ie as for forested Crown land).

With respect to Sections 1.7 and 1.8 detailed species lists are very incomplete in the Darling Range Forest Area. Any assistance the Company may care to offer in the documentation of such information would be most valuable.

1.9 IMPINGEMENT ON COMMUNICATIONS

The mining operations may impinge on communications in the following manner:

i) Danger to public from fly-rock.

ii) The invonvenience to the public by having public roads either closed during blasting and mining operations or used by heavy vehicular traffic.

For the amelioration of these possible problems the Company must liaise and cooperate with the Main Roads Department and the Local shires.

1.10 FIRE HAZARD (Covered by the Bush Fires Act. 1954)

The fire hazard in the forest regions adjacent to the mine areas is likely to be increased by:

i) increased access to the forest

ii) the increase in personnel and heavy equipment in the forest area.

iii) the introduction of some tree species, for the purpose of rapid reafforestation, which may be more flammable than the pre-existing native species.

iv) the practice of wind-rowing and burning waste vegetative material prior to mining.

The Company must liaise, cooperate and follow the advice of the Forests Department, the Bush Fires Board and the local shires with respect to the problem of fire. The Company must minimise the fire risk by the use of spark arrestors on vehicles where practical.

The Company must also maintain, at all times, an adequate fire fighting unit which is on stand-by whenever the mining operation is in progress.

1.11 RECREATION AND AESTHETIC DEGRADATION

The Darling Range area adjacent to Perth is extensively used by residents at the metropolitan area for weekend recreation such as sightseeing, scenic drives, picnics, etc. In view of the

future expansion and population growth of the metropolitan area, the demand and need for such recreation will increase. With this in mind and where the land is Crown land, the Company must:

i) liaise and coordinate with the Community Recreation Council, the Forests Department and the Department of Tourism, and where practical follow their advice in maintaining and/or enhancing the recreational potential of the area; and

ii) minimise the aesthetic degradation of any aspect of the mining operation in accordance with recommendations from the Forests Department, Community Recreation Council, National Parks Board and the local shires.

Where the land is private land, owned by a third party (ie not the Company), the Company must minimise the aesthetic degradation of any aspect of the mining operation on, or adjacent to, the private land.

Where the Company is the proprietor of the freehold land, the Company must, in accordance with the terms of its Agreement, minimise the aesthetic degradation of any aspect of the mining operation on, or adjacent to that private land. This should include where practical the creation of visual buffer zones and the leaving and/or replanting of areas of natural forest.

2. THE REFINERY

2.1 WATER

2.1.1 Water Quantity

The roofs of the refinery buildings, the refinery roads and parking areas and adjacent cleared areas will all act as local water catchment areas thereby increasing surface run-off which can cause problems of:

i) Erosion
ii) Siltation
iii) Turbidity.

Adequate provision, including:

> the construction of storm water drainage channels and compensating pits or settling ponds where required,

must be undertaken by the Company to ensure the minimum environmental damage from increased surface run-off.

2.1.2 Water Quality

i) Turbidity and Siltation: Increased surface run-off can cause the problems of turbidity and siltation, which can affect water quality if such run-off goes into water catchment areas. Methods of control and amelioration are covered under Section 2.1.1.

ii) Chemical: The spillage of lubricating oil, liquid fuels, caustic soda and other such chemicals in the refinery area is likely to cause water pollution. Adequate provision must be undertaken by the Company to restrict and control such causes for the contamination of surface and ground waters.

iii) Biological: Adequate provision must be made by the Company to ensure that the biological contamination of surface and ground water systems does not occur through such means as sewerage disposal etc.

iv) In all areas of water quality and quantity management, the Company must cooperate and coordinate with those organisations currently studying these problems (eg Public Works Department, Hunt Steering Committee and CSIRO).

2.2 NOISE (Partially covered by the Noise Abatement Act, 1972 and The Traffic Act, 1919)

The following are likely sources of noise which the Company must undertake to minimise:

i) Refinery equipment - stationary
ii) Mobile machinery and vehicles.

In the instance of 2.2(ii) the Company must undertake to fit mufflers on all mobile equipment and vehicles where practical. In the case of 2.2(i) the Company should monitor all equipment and fixed plant noise to determine the maximum noise levels which are acceptable both to Company personnel working at the refinery, and to non-Company personnel utilising the adjacent areas.

2.3 EMISSION TO THE ATMOSPHERE (Covered by the Clean Air Act, 1964 and the Traffic Act, 1919-1972)

Likely sources of emission to the atmosphere are:

i) Dust from Company vehicles on Company dirt roads (if any) in the refinery area.
ii) Stack emissions from the refinery .
iii) Exhaust emissions from: a) fixed refinery plant,
b) Company vehicles.

With respect to 2.3(i) the Company must investigate the best methods of dust suppresion. If there are to be dirt roads at the refinery, this would include the adequate watering of these roads.

With respect to 2.3 (ii) and (iii) (a) the requirements of the Clean Air Act, 1964, must be met.

With respect to 2.3 (iii) (b), at present national standards for all forms of vehicle emission are not currently established. However, the Company will endeavour to minimize such emissions and upon the introduction of quantified standards, the Company must make provisions for these standards to be met.

2.4 ODOURS (partially covered by Clean Air Act, 1964)

On the point of offensive odours, the Company should liaise and coordinate with the Clean Air Section of the State Public Health Department.

2.5 AESTHETIC DEGRADATION

The Company should attempt to minimise any aesthetic degradation resulting from the construction and/or operations of the refinery. In so doing they should consult the Forests Department for advice on the most suitable types of trees for the purposes of providing vegetative screens. On this point the Company should also seek the advice of the Community Recreation Council.

3. THE RED MUD DISPOSAL PONDS

3.1 WATER

Adequate provision, including:

i) the sealing of the floor of the red mud ponds to prevent chemical contamination of the ground water resulting from seepage;

ii) continual bore-hole monitoring adjacent to all sides of the red mud ponds to ensure that ground water contamination is not occuring;

iii) adequate design of the red mud ponds to ensure that there is no surface run-off of water from these ponds as this would also cause chemical contamination of local drainage systems,

iv) adequate design and safeguards, of the red mud ponds, retaining walls to ensure that there is no possibility of them breaking under maximum conditions of rainfall and/or flooding,

must be taken by the Company to ensure that no environmental damage occurs by either increased surface run-off or chemical contamination of local drainage systems and/or ground water.

3.2 AESTHETIC DEGRADATION AND REHABILITATION

Adequate provision, including revegetation and/or reafforestation, must be taken to minimise any aesthetic degradation of the local environment resulting from the construction and use of the red mud disposal ponds. The Company, on this matter, must liaise and seek the advice of both the Forests Department, the Department of Agriculture, the local shire and any organisations with experience in the revegetation of red mud ponds.

3.3 EMISSIONS TO THE ATMOSPHERE

Prior to the establishment of an adequate vegetative cover on the red mud ponds, there is likely to be a dust problem. The Company must undertake to minimise this problem and to take the quickest means of establishing a vegetative cover on the disposal ponds. This should include the rapid establishme of a grass or cereal crop cover which would reduce the dust problem until such time as the area can either be reafforested or put to some other appropriate use.

3.4 FAUNA (Covered by the Fauna Conservation Act 1950)

From experience at Kwinana it is known that waterfowl will settle with fatal results on the highly caustic red mud ponds. Suitable deterrents have reduced this problem although further research is needed. The Company must liaise and cooperate with the Wildfowl Section of the Department of Fisheries and Wildlife and with any organisations with experience in the amelioration of this problem.

4. THE PORT AREA

4.1 NOISE (Covered by the Noise Abatement Act, 1972 and the Traffic Act, 1919)

The Company must undertake to reduce all noise, associated with the load-out at the chosen port site, to acceptable levels.

4.2 EMISSIONS TO THE ATMOSPHERE (Covered by the Clean Air Act 1964).

Dust from the load-out is a possible problem and the Company must undertake to minimise dust emission. On this point the Company should also liaise with both the State Public Health Department and the local Authority. Particular attention must be given to avoiding the contamination of sensitive or food materials being on or off loaded in the vicinity of the alumina load-out.

5. COMMUNICATIONS AND TRANSPORT LINKS

5.1 ROAD

Where Company vehicles, particularly heavy duty trucks etc. are using public roads, the Company must undertake to meet both the requirements of:

a) the Main Roads Department and the Local Authorities to minimise inconvenience to the public; and

b) the State Public Health Department and the local authorities to minimise excessive noise and potential dust problems.

5.2 RAIL

Where rail operations will be built and operated by the Western Australian Government Railways, it is recognised that it is the responsibility of the WAGR to:

a) minimise associated noise levels ; and

b) control the spread of *Phytophthora* during construction of the railways through infected areas of forest.

Where rail operations will be built and operated by the Company, the management and amelioration of the above aspects are the responsibility of that same company.

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WILLIAM C BROWN, Government Printer, Western Australia