AUSI iron project, DR/HBI Plant, Cape Lambert, Western Australia

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Australian United Steel Industry Pty Limited

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 794
December 1995

THE PURPOSE OF THIS REPORT
This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's report.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding Environmental Conditions which might apply to any approval.

APPEALS
If you disagree with any of the contents of the assessment report or recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS
Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005
CLOSING DATE
Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 22 December 1995.

Environmental Impact Assessment (EIA)

Process Timelines in weeks

Date	Timeline commences from receipt of full details of proposal by proponent	Time (weeks)
25/9/95	Proponent Document Released for Public Comment	4
23/10/95	Public Comment Period Closed	
2/10/95	Issues Raised During Public Comment Period Summarised by EPA and Forwarded to the Proponent	4
20/11/95	Proponent response to the issues raised received	7
6/12/95	EPA reported to the Minister for the Environment	3

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Summary and recommendations

The proponent, Australian United Steel Industry Pty Limited, proposes to construct and operate a Direct Reduction/Hot Briquetted Iron plant near Cape Lambert in the Pilbara region of Western Australia.

This proposal has been assessed by the Environmental Protection Authority at the level of Consultative Environmental Review (CER).

During the assessment the EPA sought public submissions and expert advice from the Department of Environmental Protection, the Department of Conservation and Land Management (CALM), The Fisheries Department of WA, the Department of Minerals and Energy (DOME) and the Water Authority of Western Australia (WAWA), and has concluded that the main biophysical, pollution and social issues relating to the proposal were:

Biophysical

- marine and near shore impacts associated with the intake and discharge of ocean water for cooling purposes and from clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), especially impacts on mangroves and corals, sea turtles, dugongs and other marine life; this also includes the development of an oil/chemical spill contingency plan; and
- protection of terrestrial flora and fauna.

Pollution

- potential impacts on groundwater and existing surface hydrology (such as stream location, flood plain alteration) due to the construction and operation of the plant and tailings dams;
- gaseous emissions (including greenhouse gases and odours), and the lack of proper climatic data to facilitate effective computer modelling of air emissions;
- dust and particulate emissions;
- liquid and solid waste disposal; and
- noise.

Social surroundings

- economic development within the region;
- aboriginal heritage;
- adequacy of existing infrastructure to accommodate workforce.
- community consultation; and
- cultural significance of Dixon Island and other nearby islands.

The Environmental Protection Authority during its assessment has utilised the information given in the Consultative Environmental Review (CER) and has taken into account the advice of the above expert agencies and additional information supplied by other government agencies, the public and the proponent.

The Environmental Protection Authority has concluded that the proposal is environmentally acceptable subject to the proponent's commitments and the recommendations in this assessment report, particularly with respect to the scope and content of the proponent's Environmental Management Programme (EMP). However, the EPA's conclusion is based on the understanding that if new port facilities are required by the proponent, then these facilities would subject to separate formal assessment by the EPA.

Recommendation Number	Summary of recommendations
1	The proposal is acceptable subject to the recommendations in this report, the proponent's commitments, and the Authority's recommended environmental conditions.
2	The proponent should prepare a 2 stage EMP detailing the following to the requirements of the EPA, on advice from the DEP: Stage 1 - before commissioning, the EMP shall address, but not be limited to the following: 1. Ocean cooling water intake and discharge • the nature and location of the intake, and discharge points on the Robe River Mining Co Ltd jetty; • predict the ocean water quality, including water temperature change at and around the ocean outfall and compare it to an agreed water quality standard, including commitments (Appendix 5); • the sensitivity of the marine ecosystem to changes in temperature and the adequacy of a $4^{o}C$ above ambient ocean water temperature discharge limit (Commitment 17 Appendix 5); • the method for determining the mixing zone; • baseline monitoring of environmental conditions at and around the ocean outfall; and • an oil/chemical spill contingency plan. 2. Groundwater and existing surface water hydrology • the control of surface water, runoff, drainage and tailings dam such that the ground water is protected ; • a water efficiency and conservation programme relating to the usage of fresh water; and • a monitoring and audit programme for ground water and surface water quality at and around the plant and tailings dam, with particular emphasis on iron as an indicator. 3. Gaseous emissions (including greenhouse gases and odours) • a monitoring and audit programme for all gaseous and odorous emissions (stack and ambient), including greenhouse gases; • calculations of the greenhouse gas emissions associated with the proposal (using standard methodology developed for Australia); • note the Governments desire to stabilise greenhouse gas emissions by the year 2000 and progressively reduce them thereafter. Also note the Revised Greenhouse Strategy for Western Australia 1994 and the United Nations Framework Convention on Climate Change (FCCC); and • the proponent shall use their best endeavours to comply with the Government position and FCCC Convention on greenhouse gas emissions and report on their progress.

Recommendation Number	Summary of recommendations
2	4. Dust and particulate emissions • a monitoring and audit programme for all dust and particulate emissions (including fugitive dust) and the moisture content of storage stockpiles as a means of gauging the effectiveness of dust control. 5. Liquid and solid waste disposal • an inventory of the volume, contents and location of all waste disposal sites. These details should be indicated on the site plan for future reference; and • details of waste disposal approvals obtained by the proponent from relevant government authorities. 5. Noise • a noise assessment of the overland conveyor. Stage 2 - After commissioning, the EMP shall address, but not be limited to the following: 1. Ocean cooling water intake and discharge • verification that mixing and the transport of cooling water at the ocean outfall meets the agreedstandard; • rectification measures in the event that monitoring indicates that water quality, including cooling water discharge mixing and transport at the ocean outfall are not to the agreed standard; and • details of mangroves lost during construction or operation of the project and proposed rehabilitation programme. 2. Groundwater and existing surface water hydrology • a rehabilitation plan and closure strategy for the tailings dam; Reports of the analysis of all monitoring programmes are to be submitted at appropriate intervals to the DEP for audit, and are to be made publicly available.
3	The Environmental Protection Authority recommends that the proponent should undertake a fauna field survey of the region with the view of appropriate rehabilitation as required, prior to the proposed plant being commissioned, in order to quantify the results of the desktop study detailed in the CER.
4	The Environmental Protection Authority considers that as a result of the increasing interest in industrial development in the Karratha to Cape Lambert area, surface air quality climatic data should be collected and a meteorological measurement network established so as to ensure accurate air quality computer modelling predictions can be performed for future proposals. Accordingly, the EPA recommends that government should establish a suitable meteorological measurement network and climatic data collection programme to achieve this objective.

1. Introduction and background

1.1 The purpose of this report

This report and recommendations provide the Environmental Protection Authority's formal advice to the Minister for the Environment on the environmental acceptability of the proposed development of a Direct Reduction/Hot Briquetted Iron (DR/HBI) plant near Cape Lambert, Western Australia (Figure 1).

1.2 Background

The AUSI Iron Project was initiated in 1994. This project would bring together the natural gas and iron ore resources of the Pilbara to produce metallic iron for sale primarily to the steel industry of East Asia.

The project builds on a large body of technical and commercial knowledge developed over the past 25 years on the characteristics of the Pilbara iron ores with respect to secondary processing and the changing role of metallic iron in the Asian steel industry.

Previous studies have indicated that for such a secondary processing project to be viable, it is necessary to utilise some of the existing infrastructure in the Pilbara. The project is to be located near Cape Lambert where there is ready access to iron ore and the infrastructure of Karratha.

1.3 The proposal

Australian United Steel Industry Pty Limited (AUSI) proposes to construct and operate a Direct Reduction/Hot Briquetted Iron (DR/HBI) plant near Cape Lambert in the Pilbara region of Western Australia (Fig.2).

The proposed plant will utilise conventional and commercially proven ore concentration, pelletising and gas-based shaft furnace direct reduction technologies to convert Pilbara iron ore (fines and lump) into HBI. The production capacity of the plant is expected to be 3.6 million tonnes per year (Mtpa) of HBI. The project may be developed in stages depending upon the economic conditions and market requirements for HBI. If the development is staged, then the first stage would consist of two DR shaft furnaces with an expected capacity of 2.4Mtpa of HBI. The second stage would involve the addition of the third DR shaft furnace to bring the plant to its planned maximum capacity. The concentrator and pelletiser constructed as part of the first stage would be sized to accommodate the Stage 2 capacity. The Consultative Environmental Review (CER) for this proposal has been prepared on the basis of a HBI production rate of 3.6Mtpa.

Gas-based shaft furnace technology will be used to take advantage of the reserves of high quality and competitively priced natural gas in the nearby North West Shelf gasfields. The reduction process (iron oxide ore to metallic iron) will not produce solid wastes or slags. Neither will it produce the environmental problems associated with the conventional coal/coke based smelting processes. The shaft furnace, in contrast to smelting processes, emits relatively clean off-gases from combustion of natural gas with low sulphur levels.

The project will also have a gas-fired power station which will consist of gas turbines with a total generation capacity of approximately 120MW. The maximum energy demand for the complete plant is expected to be 117MW.

The proposed DR/HBI plant will be located on a 500ha site adjacent to Mount Anketel, approximately 5.5km west-northwest of Wickham (Fig.2). Iron ore will be delivered by rail using the existing Robe River Mining Co. Ltd (Robe River) railway line and the HBI will be transported to the port by overland conveyor. Gas will be supplied by Pilbara Energy Pty Ltd from the Karratha to Port Hedland gas pipeline which runs in an east-west direction approximately 8km south of the proposed plant site.

Construction is planned to commence in the first quarter of 1996 and is expected to take place over a two-year period, with commissioning scheduled to occur in 1998.

1.4 Assessment process history

A flow chart of the Environmental Impact Assessment process is shown in Appendix 1. The proponent referred the proposal to the Environmental Protection Authority (EPA) on 30 March 1995 for assessment. The EPA set the level of assessment at Consultative Environmental Review (CER). During the environmental assessment of this proposal the EPA utilised information supplied by other government agencies, the public and the proponent.

The CER was prepared in accordance with guidelines issued by the EPA. The CER document was released for public review for an 4 week period ending on 23 October 1995. A summary of issues raised in public submissions was prepared and forwarded to the proponent, and the proponent's responses were taken into account during this EPA assessment. Additionally, officers of the DEP carried out site inspections, attended public meetings and discussed environmental issues with interested members of the local community and relevant government departments.

This EPA Bulletin is provided as advice to the Minister for the Environment and published. After a 14 day appeal period, the Minister sets Environmental Conditions relating to the proposal.

1.5 Structure of the report

This document has been divided into seven sections. Section 1 describes the historical background to the proposal and its assessment while Section 2 briefly describes the proposal (more detail is provided in the proponent's CER and in Appendix 4). Section 3 explains the method of assessment, the structure of this report and provides an analysis of public submissions.

Section 4 sets out the evaluation of the key environmental issues associated with the proposal. Each sub-section details the objective of the assessment, the likely effect of the proposal, the comments from submissions and the proponent's response to submissions. The adequacy of the response by the proponent is considered in terms of project modifications and environmental management commitments in achieving an acceptable outcome. The Environmental Protection Authority analysis and recommendations with respect to the identified issues are contained in this section. Where inadequacies are identified, recommendations are made to achieve the environmental assessment objectives. Section 5 summarises the conclusions and recommendations. Section 6 outlines the recommended environmental conditions. References cited in this report are provided in Section 7.

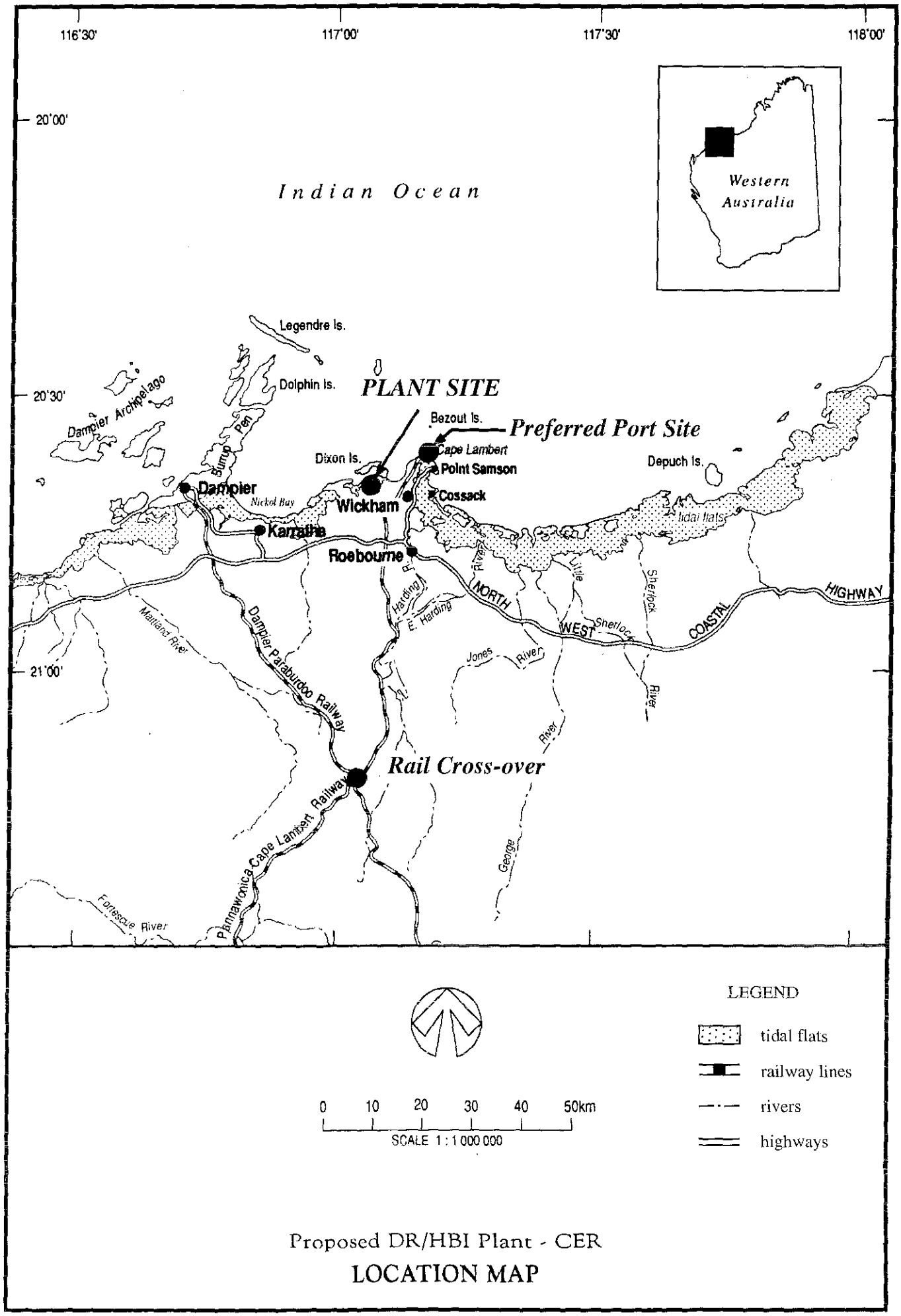

Figure 1. Regional Location map, proposed DR/HBI Plant. (Source: Figure 1.1 of the CER)

2. Summary description of proposal

2.1 Need for the proposal

The development of the DR/HBI plant has been proposed by the proponent in response to the growing world demand for HBI which is primarily used as feed stock for electric arc furnaces. The plant would add value to iron ore that is currently exported for downstream processing in overseas countries. The proponent considers that the AUSI Iron Project would have a number of other significant benefits including:

- increased export earnings for the State;
- further utilisation of the natural gas resource of the region;
- creation of employment opportunities;
- flow-on economic growth of the region;
- establishment of value-added resource processing;
- provide potential for further downstream manufacturing;
- creation and diversification of markets for WA iron ore; and
- better utilisation of existing infrastructure.

The CER indicated that the economic feasibility of DR/HBI plants located in the Pilbara has improved significantly with the deregulation of the gas industry. The proximity of Cape Lambert to markets in Asia further enhances the competitive nature of the project.

2.2 Summary of proposal.

As shown in Figures 1 and 2, the area affected by the proposed AUSI Iron Project will consist of four main parts as follows:

- the DR/HBI plant site (including a fine tailings dam and a coarse tailings disposal area);
- service corridors for rail, road, water, gas and HBI conveyor;
- port facilities; and
- a rail crossover in the northern end of the Millstream Chichester Range National Park.

The major components of the AUSI Iron Project are as follows:

- iron ore concentrator;
- iron ore pellet plant;
- DR/HBI plant including a fine tailings dam, a coarse tailings disposal area and a rail crossover between the Hamersley Iron and the Robe River railway line in the northern end of the Millstream-Chichester Range National Park;
- raw material and product handling systems;
- port facilities;
- power generation facilities; and
- maintenance and administration facilities.

The primary raw materials required for the project are:

- Iron Ore: Approximately 6.3Mtpa of iron ore of which a maximum of 25% will be lump ore.

- Limestone and Dolomite: Approximately 60,000tpa of limestone and 11,000tpa of dolomite are expected to be used.
- Organic Binders: Approximately 3,000tpa of binder will be required.
- Natural Gas: The estimated gas requirement for this DR/HBI project is a maximum of 1.2 x $10^9 m^3$ per year or 6,152GJ/yr.
- Water: The project will use approximately 3.3 million cubic metres per annum (Mm^3pa) of fresh water. The plant will also use approximately 5.4Mm^3pa of seawater for the cooling circuit, with some 1.34Mm^3pa of brine being returned to the ocean.

The major wastes discharged to the environment comprise:

- brine discharged into the ocean - 1.34Mm^3pa;
- fine and coarse tailings - 1.31Mtpa;
- sulphur dioxide - 126kg/hr;
- nitrogen dioxide - 354.1kg/hr;
- hydrogen sulphide - 1.0kg/hr;
- carbon dioxide - 2.8Mtpa; and
- particulates - 355mg/m^3

The major inputs and outputs of the DR/HBI Project are summarised in Figure 3 and a simplified iron ore/HBI mass balance flow chart is provided in Figure 4 .

The proponent's detailed description of the proposal is provided in Appendix 4.

MAJOR INPUTS AND OUTPUTS
PRPOPOSED DR/HBI PLANT

Component	Input	Output
Iron Ore		
- Fine	4.66Mtpa	
- Lump	1.65Mtpa	
- Fine Tailings		0.52Mtpa
- Coarse Tailings		0.79Mtpa
Natural Gas	6,152GJ/Hr	
Limestone	60,000tpa	
Dolomite	11,000tpa	
HBI		3.6Mtpa
Water		
- Scheme	3.29Mm^{3}pa	
• Evaporation and Offgases		2.19Mm^{3}pa
• Dust Suppression		0.09Mm^{3}pa
• Machine Cooling & Amenities		0.03Mm^{3}pa
• Tailings Disposal		0.97Mm^{3}pa
- Ocean	5.38Mm^{3}pa	
• Evaporation		4.04Mm^{3}pa
• Ocean Disposal		1.34Mm^{3}pa

Atmospheric Emissions

Emission Source	Sulphur Dioxide (kg/hr)	Nitrogen Dioxide (kg/hr)	Hydrogen Sulphide (kg/hr)	Particulate (mg/m^3)	Volume (Nm^3/hr)
Pellet Plant					
• Hood/Windbox Exhaust	70.0	70.0	0.0	100	1,347,333
• Discharge Scrubber	0.0	0.0	0.0	100	99,704
HBI Plant					
• DR Shafts (total)	55.8	5.9	0.7	50	338,670
• Screening Station (total)	0.0	0.0	0.0	50	189,906
• De-Pressuring Scrubbers (total)	0.0	0.0	0.3	50	62,742
• Reformer Flue	0.1	219.2	0.0	5	556,326
Power Station (total)	0.1	66.0	0.0	0	1,596,790

Figure 3. Major inputs and outputs of the proposed DR/HBI Plant. (Source: Table 3.9 of the CER)

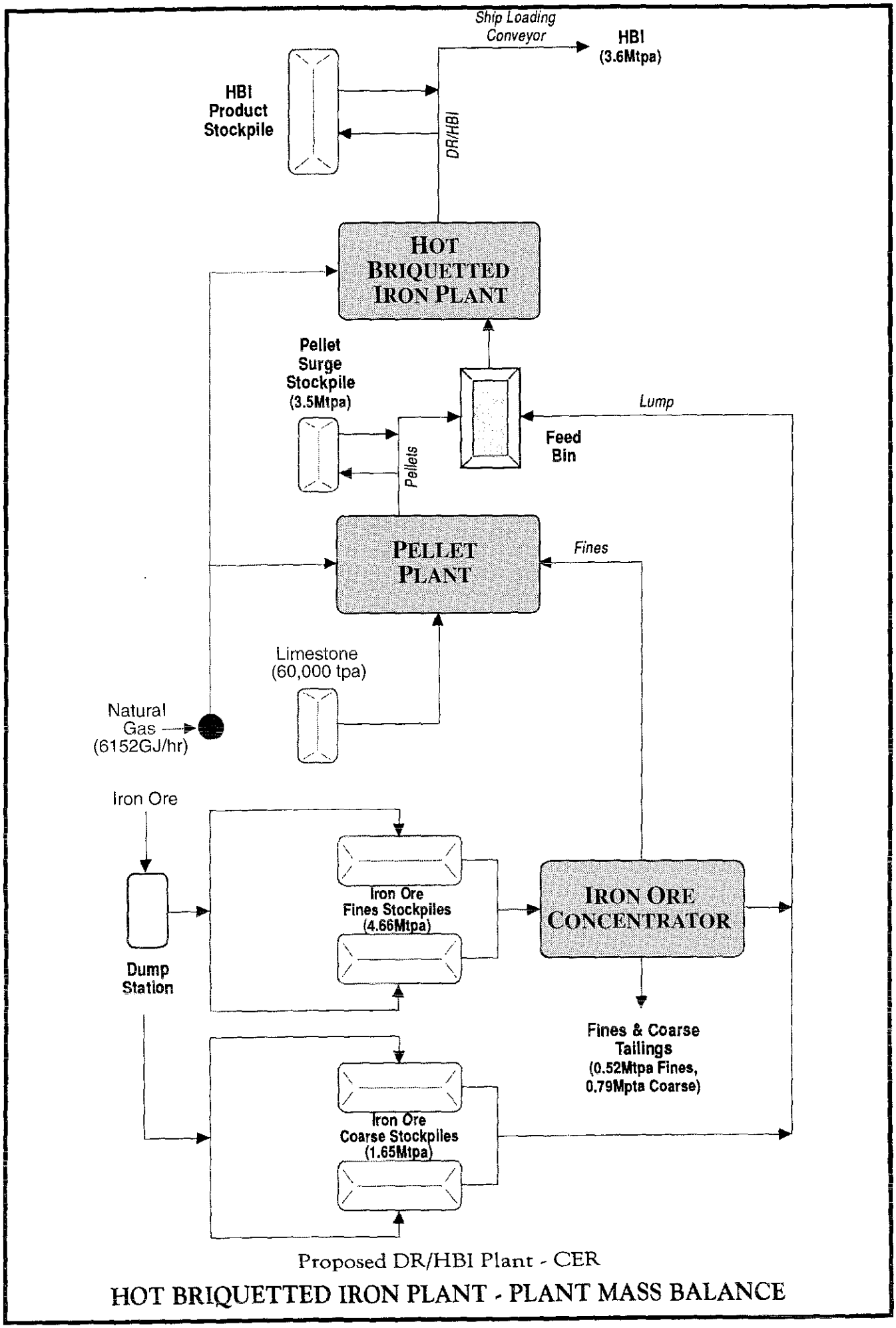

Figure 4. DR/HBI Plant – mass balance. (Source: Figure 3.4 of the CER)

3. Identification of environmental issues

3.1 Method of assessment

The purpose of environmental impact assessment is to determine whether a proposal is environmentally acceptable or under what conditions it could be environmentally acceptable.

A set of administrative procedures has been defined (refer to flow chart in Appendix 1) in order to implement this method of assessment.

The first step in the method is to identify the environmental topics to be considered. A list of topics (or possible issues) is identified by the Environmental Protection Authority through the preparation of guidelines which are referred to relevant agencies for comment prior to being finalised.

In the next main step these topics are considered by the proponent in the Consultative Environmental Review (CER) both in terms of identifying potential impacts as well as making project modifications or devising environmental management strategies.

The CER is checked by the DEP to ensure that each topic has been discussed in sufficient detail by the proponent prior to release for government agency and public comment. The submissions received as aresult of public review are summarised by the Department of Environmental Protection on behalf of the Environmental Protection Authority. This process can add environmental issues which need to be evaluated in terms of the acceptability of potential environmental impacts.

Proponents are invited to respond to the topics raised in submissions. Appendix 2 contains a summary of the topics raised in submissions and the proponent's response to those topics. A list of submitters appears as Appendix 3. Fourteen submissions were received, of which six were from government agencies and eight from members of the public and conservation groups.

The proponent's revised commitments following their response appears in Appendix 5.

This information, namely the Guidelines, the proponent's CER, the submissions and the proponent's response, is then subjected to analysis for environmental acceptability. For each environmental issue, an objective is defined and where appropriate an evaluation framework identified.

The expected impact of the proposal, with due consideration to the proponent's commitments to environmental management, is then evaluated against the assessment objective. The Environmental Protection Authority then determines the acceptability of the impacts. Where the proposal has unacceptable environmental impacts, the Environmental Protection Authority can either advise the Minister for the Environment against the proposal proceeding or make recommendations to ensure the environmental acceptability of the proposal.

Limitation

This evaluation has been undertaken using information currently available. The information has been provided by the proponent through preparation of the CER document (in response to guidelines issued by the Environmental Protection Authority), by Department of Environmental Protection officers utilising their own expertise and reference material, by utilising expertise and information from other State government agencies, information provided by members of the public, and by contributions from Environmental Protection Authority members.

The Environmental Protection Authority recognises that further studies and research may affect the conclusions. Accordingly, the Environmental Protection Authority considers that if the proposal has not been substantially commenced within five years of the date of this report, then any approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Environmental Protection Authority.

- lack of field survey for fauna;
- conservation status of flora and fauna found in the region; and
- source of limestone and dolomite required by the DR/HBI plant and potential environmental impacts associated with the supply of these materials.

Pollution

- potential impacts on ground water and existing surface hydrology (eg stream location, flood plain alteration) due to the construction and operation of the plant and tailings dams;
- gaseous emissions (including greenhouse gases and odours), and the lack of proper climatic data to facilitate effective computer air emissions modelling;
- dust and particulate emissions;
- liquid and solid waste disposal;
- noise;
- energy and water requirements, particularly water conservation strategies;
- risks and hazards (including hazards associated with dimethyl disulphide);
- buffer zones; and
- consultation and input from the regional offices of the Department of Environmental Protection (DEP) and the Department of Conservation and Land Management (CALM) on the scope and content of proponent's environmental commitments.

Social surroundings

- economic development within the region;
- aboriginal heritage;
- adequacy of existing infrastructure to accommodate the workforce;
- community consultation; and
- cultural significance of Dixon Island and other nearby islands.

The Environmental Protection Authority has reviewed these topics and from them, identified specific environmental issues which require evaluation. The balance of the topics are addressed adequately through the means identified in Table 1.

3.2 Public and agency submissions

Comments were sought on the proposal from the public, community groups, as well as local and State government agencies. During the public review period of 25 September 1995 to 23 October 1995, 14 submissions were received. A summary of these submissions was forwarded to the proponent's consultants, Dames & Moore for response on behalf of the proponent.

Submissions received by the Environmental Protection Authority fell into the following categories:

- four from individual members of the public;
- four from groups and organisations; and
- six from State and other government agencies.

The principal topics raised in public submissions included:

Biophysical

- marine and near shore impacts associated with the intake and discharge of ocean water for cooling purposes and from clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), especially impacts on mangroves and corals, sea turtles, dugongs and other marine life; this also includes the development of an oil/chemical spill contingency plan; and
- protection of terrestrial flora and fauna.

Pollution

- potential impacts on ground water and existing surface hydrology (eg stream location, flood plain alteration) due to the construction and operation of the plant and tailings dams;
- gaseous emissions (including greenhouse gases and odours), and the lack of proper climatic data to facilitate effective computer air emissions modelling;
- dust and particulate emissions; and
- liquid and solid waste disposal.

Social surroundings

- economic development within the region;
- aboriginal heritage;
- adequacy of existing infrastructure to accommodate workforce; and
- community consultation.

The Environmental Protection Authority has considered the submissions received and the proponent's response as part of the assessment of this proposal.

3.3 Review of topics

Twenty one topics were identified during the environmental impact assessment process, including those topics identified in the Environmental Protection Authority's Guidelines, subsequent consultations and in the the submissions described above. These were:

Biophysical

- marine and near shore impacts associated with the intake and discharge of ocean water for cooling purposes and from clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), especially impacts on mangroves, corals, sea turtles, dugongs and other marine life; this also includes the development of an oil/chemical spill contingency plan;
- protection of flora and fauna;
- management of weeds;
- impact on migratory birds;

Table 1: Identification of environmental issues requiring EPA evaluation.

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Biophysical				
Marine and near shore impacts associated with the intake and discharge of ocean water for cooling purposes and clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), especially impacts on mangroves, corals, sea turtles, dugongs and other marine life. Development of an oil/chemical spill contingency plan by the proponent.	Possible construction of a new port facility and cooling water discharge pipelines could require clearing, dredging and filling in the inter-tidal zone and near shore environment. The plant will use ocean water for cooling and will discharge it at a higher temperature and salinity level. Shipping and other activities increase the risk of oil and chemical spills.	WAWA - consequences of cyclonic events on the coarse tailings dam. The Australian Nature Conservation Agency (ANCA) - preferred if existing port facilities were used. Also concerned about impact of port facilities, infrastructure and activities on marine environment, especially turtles and dugongs. Australian Heritage Commission - impacts on the National estate values of Dixon Island. Fisheries Department of WA - impact of ocean cooling water intake and discharge on local marine ecosystems. DEP - monitoring requirements, commitment for remedial action, heavy metal contamination, impacts cooling water intake and discharge on marine environment, proponent should make a commitment to prepare an oil/chemical spill contingency plan.	Concern about impacts on fish, coral etc and downstream impacts on local fishermen from intake and discharge of ocean cooling water. Concerned about impacts from heavy metals, tailings dam and potential new port facilities. Procedures for oil spills should be included in the EMP.	The range of potential marine impacts associated with the intake and discharge of ocean water for cooling purposes and clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), needs further evaluation by the EPA. The need to prepare an oil/chemical spill contingency plan requires further evaluation by the EPA.

Table 1: Identification of environmental issues requiring EPA evaluation. (cont'd)

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Impact on terrestrial flora and fauna.	Construction of the plant will disturb existing flora and fauna habitats.	CALM - copy of flora list requested. Also details of as yet unidentified species requested. DOME - impacts on flora and fauna were not adequately addressed.	Concern about disturbance of existing flora and fauna habitats.	The impacts on flora and fauna need further evaluation by the EPA.
Management of weeds.	Construction and operational activities of plant could facilitate spreading of weeds.	CALM - important that the company control the spread of ruby dock at the Millstream crossover.	None received.	The issue requires further evaluation by the EPA (individually under the Flora and Fauna heading).
Impacts on migratory birds	Region is a habitat of migratory birds.	ANCA - impacts on migratory birds.	None received.	The issue requires further evaluation by the EPA (individually under the Flora and Fauna heading).
Lack of field survey for fauna.	The proponent did not carry out a fauna field survey.	ANCA - proponent needs to undertake field surveys of flora and fauna.	Proponent should have undertaken a fauna field survey. Need for flora study of Dixon Island. Adequacy of desktop fauna study questioned.	The need for a fauna field survey requires further evaluation by the EPA (individually under the Flora and Fauna heading).
Conservation status of flora and fauna found in the region.	Conservation status of flora and fauna found in the region was provided.	ANCA - important to properly identify the conservation status of flora and fauna .	None received.	The issue requires further evaluation by the EPA (individually under the Flora and Fauna heading).
The source of limestone and dolomite.	Location of source not identified by proponent in CER.	CALM - details of source of these materials is required. DEP - no information provided, extraction could have impacts.	Concern about impacts of sourcing these materials from environmentally sensitive areas.	Proponent has indicated that the source of these materials has not been determined. Evaluation of proposals for raw materials supply will be done separately. This issue requires no further EPA evaluation in this assessment report at this point.

Table 1: Identification of environmental issues requiring EPA evaluation. (cont'd)

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Pollution				
Impact on ground water and existing surface hydrology.	Construction and operation of the plant (including tailings dam) will require modification of existing surface water features. Ground water could be affected.	DEP - monitoring of ground water quality, water conservation, amelioration of impacts, impact on mangroves, cyclonic impact on tailings dam. CALM - cyclonic impact on tailings dam. DOME - management of impacts, cyclonic impact on tailings dam. WAWA - monitoring programme for surface water quality, water conservation, amelioration of impacts of contaminated surface run off.	Impact on ecosystems from changes to existing surface hydrology. Concern over location of tailings dam and loss of mangroves and disturbance to drainage patterns.	Potential impacts on ground water and existing surface hydrology requires further evaluation by the EPA. This includes potential impacts on mangroves.
Gaseous emissions (including greenhouse gases and odours).	Operation of the plant will generate large quantities of greenhouse gases. The plant will also generate odorous gases.	DEP - concerned about greenhouse gases (including sink compensation), use of low NO_x technology, odours, H_2S, SO_2, etc. Also black smoke from flaring and the lack of suitable climatic data for the region. DOME - concern over accuracy of SO_2 emission rates.	Contingency plans to accommodate upset conditions and the impacts of gaseous emissions on Wickham residents.	Gaseous emissions (including greenhouse gases and odours) requires further evaluation by the EPA.
Dust and particulate emissions.	Operation of the plant will generate dust and particulate emissions.	DEP- concerned about baseline and on-going monitoring of dust and particulate emissions and scope of Commitment 12.	None received.	Dust and particulate emissions (particularly monitoring requirements) requires further evaluation by the EPA.

Table 1: Identification of environmental issues requiring EPA evaluation. (cont'd)

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Liquid and solid waste disposal.	Operation of the plant will produce liquid and solid waste.	DEP - concerned about long term scenario for tailings disposal, management after decommissioning, effect of increasing production rates on tailings volume. WAWA - proponent should include a commitment for liquid waste disposal. Concerned about disposal locations for waste water contaminated with sodium metabisulphite . DOME - concerned about tailings dam storage details. Proponent should prepare an inventory of the volume, contents and location of all waste disposal sites.	Impacts of the discharge of cooling water into the marine environment. This issue is handled under the heading of marine and near shore impacts.	Liquid and solid waste disposal requires further evaluation by the EPA.
Noise.	Operation of the plant will generate noise.		Impact of noise from overland conveyor on Wickham residents.	This issue requires further evaluation by the EPA.
Energy and water requirements, particularly water conservation strategies.	The supply of natural gas to the plant still needs to be resolved by the proponent. The project will use large quantities of fresh water.	WAWA - proponent should make commitment to adopt an auditable water efficiency and conservation programme. DEP - no details or commitment for a water management plan.	Present natural gas pipeline cannot supply sufficient quantities to meet plant demands.	The proponent has indicated that natural gas supply is the subject of on going negotiations with potential suppliers. Water supply and conservation strategies require further evaluation by the EPA. This issue will be evaluated under the heading of protection of ground water and surface water.

Table 1: Identification of environmental issues requiring EPA evaluation. (cont'd)

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Risks and hazards.	Operation of the plant will introduce risks and hazards.	DOME - more information on hazards of dimethyl disulphide requested. Proponent required to conduct HAZOP study and Hazardous Zone classification of the plant.	None received.	The proponent has provided more information on the hazards of dimethyl sulphide and has indicated that it will be conducting a HAZOP study and Hazardous Zone classification of the plant, (see comments in Appendix 2). This issue requires no further evaluation by the EPA and can be managed by DOME's requirements for risk management.
Buffer zones.	The plant is remote from other land uses.	None received.	None received.	No public or agency submissions were received. In view of the remote location of the proposed plant, this issue requires no further evaluation by the EPA.
Consultation and input from the regional offices of DEP and CALM on the scope and content of proponent's environmental commitments.	The proponent would be expected to consult with both the DEP and to a lesser extent CALM, on the scope and implementation of its environmental commitments.	None received.	Commitments made by proponent will need consultation and input from regional offices of DEP and CALM.	The proponent indicated that consultation with the regional offices of the DEP and CALM was undertaken on a formal and informal basis throughout the preparation of the CER, (see comments in Appendix 2). This issue requires no further evaluation by the EPA.

Table 1: Identification of environmental issues requiring EPA evaluation. (cont'd)

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
Social				
Economic development within the region.	The project has the potential to affect economic development within the region.	None received.	Concern over Roebourne being overlooked as a beneficiary of downstream economic development.	This topic should be handled by the Shire of Roebourne and other appropriate Government departments and is not appropriate for further evaluation by the EPA.
Aboriginal heritage.	The project may affect areas of significance to Aboriginal heritage.	None received.	Concern that without public airing of the survey report in the CER, community cannot be properly informed or involved in the decision making process in relation to the potential impacts of the project on the Pilbara region.	The proponent has indicated that it has made a commitment to undertake an ethnographic and archaeological survey of the project area and obtain all approvals required by the Aboriginal Heritage Act (1972-1980). This issue should be handled by the appropriate Government departments dealing with Aboriginal affairs and heritage issues and requires no further evaluation by the EPA.
Adequacy of existing infrastructure to accommodate workforce.	The project will require accommodation for its workforce.	None received.	Concern over ability of existing infrastructure to accommodate the expected workforce.	This issue should be addressed by the appropriate local government authorities in conjunction with the proponent. This issue requires no further evaluation by the EPA.
Community consultation.	The proponent was required to undertake adequate community consultation.	None received.	Concern as to whether proponent had held discussions with the residents of Wickham	The proponent has indicated that it has consulted with the residents of Wickham and local Aboriginal groups. This issue requires no further evaluation by the EPA.

Table 1: Identification of environmental issues requiring EPA evaluation. (cont'd)

TOPICS	PROPOSAL CHARACTERISTIC	COMMENTS FROM GOVERNMENT AGENCIES	PUBLIC COMMENTS	IDENTIFICATION OF ISSUES
The cultural significance of Dixon Island and other nearby islands.	The project may affect the cultural significance of Dixon Island and other nearby islands.	None received.	Concern about how the proximity of the plant to Dixon Island and other nearby islands could affect their cultural significance.	The proponent indicated that it does not anticipate that the project will have any impact on Dixon Island's cultural significance, as Dixon Island is approximately 3km from the proposed development. This issue requires no further evaluation by the EPA.

4. Evaluation of environmental issues

The Environmental Protection Authority has considered the issues raised during the environmental impact assessment process including matters identified in public submissions. The Environmental Protection Authority has evaluated the key environmental issues identified in Section 3.2 of this report, based on existing information and advice from other Government agencies.

Biophysical issues

4.1 Marine impacts

4.1.1 Objective

The Environmental Protection Authority's objective is to protect the marine environment from potential impacts associated with the intake and discharge of ocean water for plant cooling purposes, materials handling and possible port development proposed AUSI Iron Project DR/HBI Plant.

4.1.2 Evaluation framework

Existing policy framework

The proposal would need to meet the requirements of the New Horizons In Marine Management Strategy - Government of Western Australia (November, 1994) and the Bonn Convention (refer to page 19).

Technical information

The potential marine impacts of the project cannot be directly assessed as the chosen port option will define the area within which these impacts may occur. However, the potential impacts likely to be of concern in relation to the project are:

- discharge of concentrated seawater, potentially at a higher temperature and salinity than ambient;
- loss of mangroves;
- habitat disturbance due to installation of ocean cooling water intake and discharge pipes;
- marine and near shore impacts from construction of new port facilities (eg dredging and clearing); and
- marine and near shore impacts from shipping activities (eg increased risk of oil/chemical spills, ballast water disharge).

Port Facilities

The two options for wharf facilities that are currently being considered by the proponent are:

- use of the existing Robe River Mining Company Pty Ltd's Cape Lambert facilities; or
- construction of new facilities.

The CER stated that the proponent's preferred option is to use existing facilities, and negotiations between Robe River Mining Company Pty Ltd and the proponent have resulted in an agreement in principle being reached for the use of these facilities . The use of the existing wharf facilities would require the following additional infrastructure:

- a trim storage bin for the HBI product;
- additional conveyors;

- ocean water inlets and discharge facilities; and
- pumping facilities.

The CER stated that the area surrounding the existing port facilities is already highly disturbed and that it is unlikely that any significant environmental impacts would occur as a result of the additional infrastructure. However, the CER also indicated that the proponent would undertake an environmental assessment of the potential impacts associated with these facilities.

Concentrated Seawater Discharge

The discharge of the concentrated seawater (brine) from the cooling water system is likely to represent the most significant potential marine impact. The project will discharge approximately 1.34Mtpa, or approximately 4,300m^3 per day, of brine from the facility.

The discharge temperature of the brine will depend upon the wet bulb temperature of the ambient air as this controls the effectiveness of the cooling tower system, which will be designed to cool the water to within 5°C of the ambient wet bulb temperature. Table 2 presents the seasonal wet bulb temperatures for Karratha and the expected average ocean discharge temperature.

TABLE 2
AVERAGE SEASONAL WET BULB TEMPERATURE
KARRATHA AIRPORT

Season	Average Wet Bulb Temperature (°C)	Average Cooling Water Discharge Temperature (°C)
Summer	25	30
Autumn	21	25
Winter	15	20
Spring	19	24

Seawater temperatures on the North West Shelf generally range from about 22°C (winter) to 30°C (summer). However, in inshore waters heating and cooling effects are modified by depth and circulation effects. In Mermaid Sound, an annual temperature range of 19 - 32°C has been quoted by Forde (1985). The upper temperature is regarded as being close to the thermal tolerance limit of many marine organisms (Woodside Petroleum Development Pty Ltd, 1979).

The design discharge temperatures (Table 2) are close to the average recorded values and within the range of natural variability experienced in inshore waters. However, should discharge temperatures exceed 30°C there could be cause for concern, depending on the proximity of sensitive resources, in particular coral formations.

Coastal water salinities in Mermaid Sound are typically about 36.0g/L and offshore generally vary only by about 1g/L over the course of the year. In in-shore waters, the salinity can be reduced by extreme rainfall events and run-off from the land. Such effects are strongest close to the discharges of the major rivers of the region, e.g. the Maitland River.

The discharged sea water will have a salinity of approximately four times greater than normal seawater, i.e approximately 140g/L. The CER stated that diluting this with seawater at 36g/L would require a twenty-fold dilution (actually twenty five-fold by DEP calculation) to reduce the concentration to approximately 40g/L and a fifty-fold dilution to reduce the concentration to within 1 to 2g/L of the background concentration. The CER stated that it would be reasonable to expect a 50:1 dilution at the seafloor if the brine were to be discharged through a diffuser at the sea surface.

An indication of the potential effects of discharging brine at a concentration of approximately four times seawater concentration can be obtained by comparing it to the effects of bitterns

(hypersaline salt solutions) discharged into the ocean by the solar salt industry. Off the North West Shelf, bitterns at concentrations of approximately 360g/L total dissolved salt are discharged intermittently from two solar salt fields at or upstream of the shoreline from single point discharges. Impacts on mangroves and fauna which have come into direct contact with the undiluted bitterns have been detected within the discharge channels, but to date there have been no reported impacts on mangroves on the adjacent coastline or on fauna in adjacent waters.

The CER indicated that there should be little impact on benthic organisms in the immediate vicinity of the discharge, providing that a dilution factor in the order 50:1 can be achieved. The CER also stated that, given the tidal currents which are present in the region, a dilution ratio of this order should be readily achieved. Pelagic (free swimming) organisms are able to detect changes in salinity and avoid areas in which water quality may prove injurious to health and should not be affected.

The CER indicated that the proponent proposes to discharge the brines through a diffuser which would be installed along the wharf facilities. The diffuser would be located towards the seaward end of the wharf and be designed to discharge the brines just below the water surface. This approach has several advantages over discharging the brines near the coast or on the seabed. For example, a seabed discharge would tend to spread across the seabed (due to its greater density) with little dilution. However, while a seawater surface based discharge would tend to sink (due to the density differences), the depth of water and ocean currents would facilitate its dilution. Therefore, an ocean surface based diffuser discharge will result in the greatest and most rapid dilution of the brines which will reduce its potential environmental impact. It is proposed to discharge the brine as far as practicable from the coast to ensure that its impact on coastal flora (eg. mangroves) is negligible.

The other major concern relating to the discharge of the concentrated ocean cooling water relates to the potential for heavy metal contamination of the discharge. The CER indicated that seawater will be cycled through a ceramic and fibreglass cooling tower and titanium heat exchanger. The seawater will also be pumped through plastic or cement lined pipes to minimise corrosion. Therefore, the design of the system is such that any heavy metal contamination of the seawater would be very small. The CER stated that the proponent will undertake a monitoring programme to periodically test the heavy metal content of the incoming and outgoing sea water

Ocean Cooling Water Intake and Discharge Pipes

It is proposed that the ocean water cooling intake and discharge points will be installed along the wharf used to ship the product. The impact of these facilities is expected to be minimal.

Shipping Activities

The potential impacts of the shipping activities associated with the project include the discharge of ballast water and oil spills.

Ballast water discharge is controlled by the Australian Quarantine Inspection Service which has introduced the Voluntary Guidelines of Ballast Water and Sediment Discharge from Overseas Vessels Entering Australian Waters. The control of ships in relationship to these voluntary guidelines rests with the Port Authority and the shipping agents. The CER indicated that the proponent will request that shipping companies comply with the voluntary guidelines.

The CER stated that procedures will be established for dealing with any oil spills which may occur. Where practical these activities will be coordinated with other port users.

Comments from key government agencies

The Fisheries Department of WA provided the following comments with respect to marine impacts:

"The high volume and concentration, and elevated temperature of this effluent indicate that its discharge could have significant localised impacts on marine ecosystems. The statements made in this report about the discharge of this effluent, namely the required dilution and site of disposal, appear reasonable but must be confirmed by investigation."

"In that regard, Commitment 16 should be undertaken as a priority. The DEP should scrutinise the investigation and interpretation of results, and consult with relevant Government agencies (eg Fisheries Department, WA Museum) where appropriate. Provided Commitment 16 is met, Commitments 17 to 19 appear adequate in order to minimise long-term impacts."

"Finally, one minor point concerning Commitment 18: the second line should read "....particularly organic pollutants and heavy metals....".."

The Department of Environmental Protection (DEP) carried out a technical evaluation of the information presented in the CER relating to marine environment impacts and detailed concerns about:

- whether or not the proponent had obtained expert advice from the Fisheries Department on the potential impact a 4°C temperature difference between the discharged cooling water and surrounding seawater could have on the marine environment;
- whether or not the proponent could provide more accurate details on heavy metal contaminants and their anticipated concentrations in the discharged cooling water;
- how the presence of heavy metals and other contaminants in the discharged cooling water would be monitored;
- what action would be taken if monitoring indicated the presence of heavy metals and other contaminants such as anti-fouling agents in the discharged cooling water;
- whether or not the proponent was prepared to make a commitment to undertake appropriate remedial action to ameliorate potential environmental impacts if contaminants were identified in the discharged cooling water;
- the need for Commitment 18 to state that sediments and oysters will be sampled during the collection of baseline data on the marine environment for a certain period prior to commissioning;
- the need for the proponent to make a specific commitment to prepare an oil/chemical spill contingency plan;
- whether or not the proponent had consulted the Nickol Bay Fisherman's Association about early monitoring and management;
- whether or not the proponent would monitor coastal water quality and be willing to make a commitment to do so; and
- the potential marine impacts from cathodic protection systems and coatings on pipelines and additional port/wharf facilities.

The Water Authority of Western Australia provided the following comment:

"The potential impact of a storm event such as a cyclone surge seems to be understated. The WAWA also considers that reduced levels (RL's) of the top of tailings dams embankments may need to be reviewed."

The Australian Heritage Commission provided the following comments:

"The Commission notes that the impacts of the proposal on the marine environment have not been considered in sufficient depth in the Consultative Environmental Review for it to assess the likely impact of the proposal on the national estate values of Dixon Island. The Commission also notes the location of the coarse tailings landfill in an area of coastal mudflats."

"The Commission therefore considers that more information on the likely impacts of the proposal on the marine environment and Dixon Island is necessary before any decision is made about the proposal."

The Australian Nature Conservation Agency (ANCA) provided the following comments:

"The CER identifies the proponent's commitment to undertake an assessment of the potential environmental impacts of the port site, associated facilities and shipping activities. ANCA

supports an option which utilised existing infrastructure whenever possible. As part of the assessment, ANCA recommends that assessment of potential impacts on the marine wildlife in the area, including impacts on marine turtles and dugongs. The marine turtles and dugong (Dugong dugong) are protected species listed under the Bonn Convention."

"Little attention appears to be given to potential impacts on the coastal and wetland environments and species associated with them. The project area and associated port activities could have deleterious impacts on this environment. The tailings dam is located in coastal areas subject to tidal and cyclonic influences. ANCA is not satisfied with the level of environmental assessment and recommends further investigations to determine the level of potential impact on this environment and associated species."

4.1.3 Public submissions

One public submission expressed concern that the CER indicated that brine discharged from the ore wharf would have a localised but acceptable impact on the marine environment. This submission stated that the CER did not clarify what an acceptable impact was nor did it detail what studies had been done to justify this assumption.

Other submissions highlighted concern about the impact of discharging cooling water at a higher temperature and with 4 times the salinity of normal seawater back into the marine environment at the port jetty. One submission questioned whether or not the discharge area would become the habitat of fish and other marine creatures which prefer highly saline seawater such as coral trout and nor-west snapper. The potential impact to local fishermen was also of concern.

The Conservation Council of Western Australia Inc detailed concerns about;

- the marine discharge temperature increase of 4°C having an adverse impact on the marine environment, particularly prawn and coral development which are both dependent on temperature change for their development;
- the levels of heavy metals which could occur in the discharge and its desire to see more precise details;
- what action would be taken if monitoring indicated the presence of heavy metals as outlined in Commitment 19. The Council stated that there should be a commitment to do something about it not just to monitor;
- inadequate information being presented in the CER to enable assessment of the impact of the provision of port facilities. The Council stated that if the proponent proceeds with construction of new port facilities, this must be subject to separate formal assessment. The Council also stated that port facilities should not be located in the conservation estate or any areas proposed for inclusion in the conservation estate, such as Dixon Island;
- the CER failing to adequately address the possible impact on the tailings dams from cyclones and higher sea levels due to the Greenhouse Effect. The Council stated that predictions indicate that water levels could rise between 0.4 and 1.5 metres and that the design of the tailings dams did not seem to have taken this into account;
- the potential impact and proposed location of the coarse tailings dam. The Council believes that the proponent should be required to find an alternative site for the dam and that the public be given the opportunity to comment on this new site; and
- that procedures for oil spills should be included in the EMP.

4.1.4 Proponent's response

In response to the issues detailed in the government agency and public submissions, the proponent provided the following comments:

"The issues surrounding the potential marine impact can not be fully investigated until the port site (and hence the location of the cooling water discharge) is finalised, as stated in Section 7.12 of the CER. The impact of the cooling water discharge will depend upon the sensitivity of the receiving environment and the Proponent has made a commitment (Commitment 16) to undertake an assessment of the proposed discharge location to assess this sensitivity. In the event that sensitive resources are identified, the Proponent will undertake modelling of the discharge plume to predict its impact and to design the discharge to minimise the impact on any such communities (Commitments 16 and 17)."

"The Proponent has also made a commitment (Commitment 17) to not discharge waters more than 4°C above the ambient ocean temperature. For the reasons stated above, the impact of this can not be fully assessed at this stage. However, the volume to be discharged is so small (approx 50L/s or 180m³/hr) that it will be diluted to background temperatures within a short distance of the proposed diffuser outfall. Therefore, it is highly unlikely that any impacts will occur beyond the mixing zone."

"The Proponent believes that the implementation of Commitments 16 and 17 will ensure that the potential impacts of the proposed cooling water discharge will be fully assessed and will be acceptable."

"We are unaware of any report or research publications which suggest that coral trout and NW snapper are attracted to highly saline seawater. To the contrary, there is evidence to suggest that adult reef fish would avoid seawater of over 45g/L. There are no reports of adult reef fish congregating around the outfall of existing brine discharges in the Pilbara. However, the volume to be discharged is so small (approx 50L/s) that it will be diluted to background concentration within a short distance of the proposed diffuser outfall. Therefore, it is highly unlikely that reef fish will occur within the mixing zone."

"Section 7.12.2 of the CER states that seawater will be cycled through a ceramic and fibreglass cooling tower and titanium heat exchangers. The seawater will be pumped through plastic or cement lined pipes to reduce corrosion. Therefore, the design of the system is such that any heavy metal contamination of the seawater would be very small. The Proponent is unaware of any water quality standards relating to titanium in ocean water. Nevertheless, the Proponent has made commitments (Commitments 18 and 19) to survey for toxic contaminants in the marine sediment and suitable marine biota from the area around the discharge. This testing would be conducted prior to commissioning and periodically during operations."

"Samples of the cooling water would be taken and sent to a certified laboratory for testing of heavy metals and any other contaminants."

"In the event of heavy metal or other contamination being identified at levels likely to be of concern (as identified by national guidelines), AUSI would assist in determining the source of the contamination. If the AUSI Iron Project is found to be the source of this contamination then AUSI would identify the source within its plant. Once AUSI has identified the source it would be modified to ensure that the discharge criteria for the contaminants are met. AUSI would also undertake remediation of any areas which have unacceptable levels of contaminants due to its operations."

"In the case of anti-foulant agents, the proponent has made a commitment (Commitment 19) to periodically monitor the concentrations of free chlorine in the ocean intake and discharge systems. The free chlorine levels in the marine discharge flow will be monitored continuously by AUSI to enable accurate dosing of the intake waters."

"Due to the toxicity of chlorinated seawater, the EPA has set the following criteria for total residual chlorine (TRC) concentrations in seawater beyond the initial mixing zone of outfalls (EPA draft Water Quality Criteria for Marine and Estuarine Waters of Western Australia):

- no single TRC reading to exceed 10ppb (0.010mg/L); and
- six month medium TRC reading not to exceed 2ppb (0.002mg/L)."

"An alarm will be set to trigger when the concentration of free chlorine in the discharge marine water approaches half of the USEPA discharge criteria of 0.2mg/L for TRC. Section 7.12.2 of

the CER indicated that a dilution ratio 50:1 should be easily achieved given the tidal regime of the area. This dilution will ensure that the guidelines for TRC are not exceeded beyond the mixing zone. In addition, the monitored data will be continuously analysed to detect any upward trend in the discharge concentration of free chlorine. This trend analysis will enable early detection of over-dosing. These measures should ensure that the levels of free chlorine beyond the mixing zone always remain below the acceptable discharge criteria."

"As stated in the response to the previous question, in the event that unacceptable levels of contamination are identified and are shown to be attributable to the AUSI Iron Project, AUSI will:

- assist in the investigations to identify the source;
- undertake remedial action on its plant if it is the source of contamination; and
- remediate the impacted area if its plant is the source of contamination."

"AUSI has made a commitment (Commitment 19) to monitor for heavy metal and free chlorine concentrations in the ocean intake and discharge streams."

"Cathodes, usually comprised of metallic zinc, are designed to corrode away in preference to the steel structures they are designed to protect. The rate of release of the oxidised zinc is slow and in waters subject to strong currents and tidal movements the potential for increase in the waters adjacent to the facilities is also low. An increase in the concentration of zinc in the sediments into the immediate vicinity of the structure may occur. The impact of such increases will depend upon the habitats and organisms present at the site where the facility is located. These will be fully investigated prior to construction (Commitment 16)."

"Coatings on submerged pipelines are mostly inert and include concrete and epoxy compounds. Antifouling compounds are generally only used on structures immersed for relatively short periods of times due to the need for re-coating at regular intervals which is generally not possible on permanently submerged structures. The coatings for the pipelines and any additional port/wharf facilities will be chosen on the basis of several factors including the potential impacts on the environment, its longevity and its cost. The DEP, CALM and Department of Transport will be consulted during this process."

"The preliminary design of coarse tailings for surge protection was to protect the tailings from being eroded as a result of the 1 in 100 year storm surge event. As stated in Section 3.9.1.2 of the CER, the preliminary design was based on the methods recommended by CERC's 1977 Shore Protection Manual and the following principal parameters:

- ground elevation at the outside toe of the dyke ranges from +1.0m, above Australian Height Datum (AHD) to higher than +4.2m, AHD;
- a preliminary estimate of the 1 in 100 year total still water level of +4.2m, AHD;
- maximum wave height is 60% of the maximum still water depth;
- outside slope of dyke is 3 horizontal: 1 vertical; and
- rock armour size is based on, 'No damage criteria and minor over topping'."

"The total still water level associated with the 1 in 100 year storm surge event was determined by WNI Pty Ltd and comprised the following:

- storm surge of 2.7m comprising:
  - inverted barometer effect 0.7m
  - geostrophic current set 1.0m
  - wave set 1.0m
- tide level of 4.7m above lowest astronomical tide (LAT) (Equal to 1.5m, AHD)."

"This estimate of total still water level is considered by WNI Pty Ltd to be accurate to within +/- 0.5m."

"The CER concluded that the preliminary design estimate was likely to be conservative (ie. resulting in higher rock armour) as factors affecting the maximum wave height such as:

- the length of the fetch;
- the shape of the coastline; and

- the direction of travel of the ocean waves

were not considered in the analysis. The presence of Dixon Island and several sand dunes in the vicinity of the coarse tailing landfill presented in the CER are likely to significantly reduce the maximum wave height and the level of storm surge protection required. Therefore, the preliminary design presented within the CER is considered appropriate."

"In any event, the current engineering design for the Project indicates that the coarse tailings dam will no longer be required. As such, storm surge protection of the coarse tailings dam is no longer an issue."

"AUSI believes that it is impractical and inappropriate for it to prepare its own oil/chemical spill contingency plan. However, AUSI is prepared to participate and contribute to an integrated contingency plan for the area."

"The Proponent has not consulted the Nickol Bay Fisherman's Association regarding early monitoring and management of the saline discharges. Primarily, this is a result of the uncertainty associated with the location of the Port site and thus the actual location of the saline discharge. However, the quantity of water being discharged is so small (approx 50L/s) that it will be diluted to background salinity and temperatures within a short distance of the proposed diffuser outfall. Therefore, it is highly unlikely that any impacts will occur beyond the mixing zone."

"The primary reason that AUSI has made Commitment 18 is to obtain sufficient information on the status of the receiving environment before its operations commence and to monitor the potential impacts of the plant. Further, Commitment 18 also states that in the event that unacceptable levels of contamination are identified, AUSI will assist in the investigations and if its plant is shown to be the source, undertake remedial action on both the plant and the impacted area."

"Potential heavy metal contamination is of interest primarily due to its toxicity and the fact that it accumulates in the receiving environment rather than being dispersed. Therefore, a long term programme to gather baseline data on the existing concentrations of toxic contaminants is not considered necessary."

"Commitment 18 states that the monitoring programmes will be established to the reasonable requirements of the Minister for the Environment."

"At its closest point, the plant is approximately 3km from Dixon Island. Due to the nature of the plant and the type/nature of the discharges it is not anticipated that the Project will have any significant impact on Dixon Island and its habitats."

"In the event that the negotiations with Robe River regarding the use of the existing Cape Lambert facilities fail, a new Port site will have to be found and undergo assessment. Should this occur and the proposed Port site is in the vicinity of Dixon Island then the potential impacts of the development on Dixon Island would be investigated."

Commitments made by the proponent

With respect to marine environment impacts, the proponent has made the following environmental commitments (refer to Appendix 5 for full list of commitments):

1. Prior to commencement of construction, the Proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment.

15. The Proponent will complete an assessment of the potential environmental impacts of the port site and the associated infrastructure. The assessment will be undertaken in full consultation with the EPA, CALM and the Department of Transport and to the reasonable satisfaction of the Minister for the Environment.

16. The Proponent will assess the sensitivity of the receiving environment to the discharge of concentrated seawater (brine) prior to the construction of the facility. These investigations and the final design of the diffuser will be developed in consultation with the EPA and to the reasonable satisfaction of the Minister for the Environment.

If sensitive resources are identified, the Proponent will model the dispersion and dilution characteristics of the discharge plume to predict its impact and design the discharge facility to minimise any impacts on such communities. These activities will also be undertaken prior to the construction of the facility, in consultation with the EPA and to the reasonable satisfaction of the Minister for the Environment.

17. During the operational phase, the Proponent will discharge the concentrated ocean cooling water using a surface-based diffuser. The discharge system will be designed to minimise any potential environmental impacts. The Proponent will not discharge waters more than $4^{o}C$ above the ambient ocean temperature. The design and operation of the diffuser will be undertaken in consultation with the EPA and to the satisfaction of the Minister for the Environment.

18. Prior to commissioning, the Proponent will undertake a survey of toxic contaminants that may occur in the effluent, particularly organic pollutants (eg. heavy metals), in the marine sediment and suitable biota from the area. Following commissioning, the Proponent will periodically undertake further testing to assess the impact of the project. The frequency of testing will be decided in consultation with the EPA and all sampling results will be supplied to the EPA on an annual basis. These activities will also be undertaken to the reasonable satisfaction of the Minister for the Environment.

In the event that unacceptable levels of contamination are identified and are shown to be attributable to the AUSI Iron Project, AUSI will:

- assist in the investigations to identify the source;
- undertake remedial action on its plant if it is the source of contamination; and
- remediate the impacted area if its plant is the source of contamination.

19. The Proponent will undertake periodic testing for the presence of heavy metals and free chlorine and other marine water quality parameters in the vicinity of the ocean intake and discharge streams during the operation of the Project and to the reasonable satisfaction of the Minister for the Environment. The frequency of the testing will be determined in consultation with the EPA and the Proponent will report the results annually unless the monitoring identifies metal levels outside of preset criteria, in which case the results will be reported to the EPA as soon as they are known.

4.1.5 Evaluation

The following evaluation is based on the assumption that the proponent successfully negotiates access to Robe River Mining Company Pty Ltd's port facilities. The EPA notes that in the event that the proponent proposes to establish new port facilities, that this would require a separate environmental assessment in the future.

Following advice from the Fisheries Department of WA, the Department of Environmental Protection and the Water Authority of Western Australia, and the proponent's response to questions raised, the EPA considers that this issue is potentially manageable. The EPA also notes the above commitments made by the proponent and the fact that they address the concerns expressed in the public submissions. The EPA understands that the potential impacts associated with the construction of new port facilities will be subject to separate formal assessment by the EPA. The EPA notes the proponent's willingness to participate and contribute to an integrated oil/chemical spill contingency plan for the area.

Notwithstanding the above, the EPA recommends that the proponent's Environmental Management Programme (EMP) should detail the following information with respect to ocean cooling water intake and discharge, to the satisfaction of the Environmental Protection Authority on advice from the DEP (Recommendation 2):

- the nature and location of the intake, and discharge points on the Robe River Mining Co Ltd jetty;

- predict the ocean water quality, including water temperature change at and around the ocean outfall and compare it to an agreed water quality standard, including commitments (Appendix 5);
- the sensitivity of the marine ecosystem to changes in temperature and the adequacy of a 4°C above ambient ocean water temperature discharge limit (Commitment 17 Appendix 5);
- the method for determining the nature of the mixing zone;
- baseline monitoring of environmental conditions at and around the ocean outfall;
- verification that mixing and transport of cooling water at the ocean outfall meets the agreed standard;
- rectification measures in the event that monitoring indicates that water quality, including cooling water discharge mixing and transport at the ocean outfall are not to the agreed standard;
- details of mangroves lost during construction or operation of the project and proposed rehabilitation programme; and
- an oil/chemical spill contingency plan.

The EPA also recommends (Recommendation 2) that reports of the results of the monitoring programme should be submitted annually to the DEP for audit, and that they should be made publicly available.

4.2 Protection of flora and fauna

4.2.1 Objective

The Environmental Protection Authority's objective is to protect flora and fauna in the Wickham to Cape Lambert region from harmful impacts associated with the development and operation of the proposed DR/HBI plant.

4.2.2 Evaluation framework

Existing policy framework

To meet the requirements of the Wildlife Conservation Act (1950) for rare flora and fauna.

Technical information

Flora

Vegetation will be disturbed in, or cleared from, a number of areas during the construction of the proposed DR/HBI plant and support infrastructure, including the sites of equipment storage areas, borrow pits and access tracks. It may also be disturbed as a result of changes to drainage patterns, wildfires and off-road recreational activities. This disturbance may also result in the loss of some individuals of *Triumfetta appendiculata* (CALM Conservation Code 3 - Poorly Known Taxa) but sustainable populations of this species do occur outside the project area and elsewhere in the region.

The CER indicated that the proponent would reduce the disturbance of flora and vegetation by:

- carefully planning the type and extent of disturbance;
- avoiding the disturbance of *Triumfetta appendiculata* habitats, where possible;
- confining temporary work areas to previously disturbed areas, where possible;
- parking vehicles and machinery only in designated locations;
- prohibiting off-road recreational activities;
- retaining root stock wherever possible during clearing operations;

- retaining cleared vegetation for respreading during rehabilitation;
- raising the awareness of the workforce about conservation issues through the environmental induction programme; and
- progressively rehabilitating disturbed areas (Section 7.18).

The environmental management of flora and vegetation will be addressed further in the EMP, in consultation with CALM.

Fauna

The CER stated that the fauna habitats in the project area are well represented throughout the region and none are considered to be significant. These habitats may support a variety of fauna, but most of these species are likely to be highly mobile and would exploit relatively large areas. It is unlikely that any of the significant fauna species which may occur in the project area (including a number of migratory bird species) will have permanent populations in the area.

The loss of fauna habitat due to clearing may lead to the disturbance of some fauna. Those species with restricted distributions and/or specific habitat requirements are more likely to be affected than those species which occupy a wide range of habitats.

Linear disturbances (such as the water and gas pipelines) may create temporary barriers to the movement of smaller animals and subdivide territories. Small reptiles and mammals may fall into open trenches and become trapped. Some burrowing species may occasionally be unearthed during earthworks.

Interruptions to surface flow as a result of the construction of tracks and roads may cause changes to downslope vegetation and, consequently, changes to the characteristics of the fauna habitat.

Other risks to fauna may include:

- indirect disturbance to off-site fauna populations
- loss of fauna habitats due to wildfires;
- the uncontrolled use of off-road vehicles; and
- accidental death and injury to fauna.

The proposed development may also result in the creation of additional bird habitats as a number of bird species are known to use project infrastructure for roosting and nesting. In addition, there is potential for migratory waterbirds (particularly waders) to use settlement ponds, holding reservoirs and wet tailings areas.

The CER indicated that the proponent would reduce the impact of the project by:

- minimising the extent of disturbance to the vegetation of the project area;
- covering all open foundation holes and trenches wherever possible to prevent injury to stock or native fauna;
- inspecting open holes and trenches regularly for trapped fauna and releasing trapped individuals;
- prohibiting firearms and domestic pets in the project area;
- rehabilitating disturbed areas progressively to minimise loss of habitat (Commitment 2);
- raising the awareness of the workforce about the conservation of fauna and their habitats through the environmental induction programme;
- avoiding direct contact with fauna wherever possible. This is particularly relevant to snakes which rarely bite unless threatened, cornered or handled;
- parking vehicles and machinery only in designated locations to minimise habitat damage;
- slowing or stopping vehicles to allow fauna sufficient time to move to safety; and
- prohibiting off-road recreational activities.

Any specific environmental management procedures to minimise disturbance to or loss of individuals of rare or significant fauna species will be identified in consultation with CALM and will be addressed in the EMP, to the satisfaction of CALM and other relevant DMAs.

Weed control

The main weeds established in the project plant area are buffel grass and kapok, while ruby dock is also present in the rail crossover area. Weeds are often highly adaptable and reproduce readily even in very poor conditions. In addition, there is a direct relationship between the degree of disturbance and the degree of weed invasion. The spread of problem weeds during the construction phase will be influenced by the following:

- crossing of sites with weed infestations;
- proximity to settlements and other sites where the weeds presently occur;
- past land use;
- movement of people, livestock and vehicles; and
- proximity to other disturbed areas.

The potential for construction machinery and other equipment to distribute weeds from and into riverine habitats is of particular concern, as these habitats will often be difficult to avoid and are highly susceptible to weed infestation.

The CER indicated that the proponent will implement a weed control programme which would ensure that weed species will not be introduced to, or spread from, the project area. This programme would be developed in consultation with CALM, the Agricultural Protection Board (APB) and other relevant DMAs and will be addressed further in the EMP. The key components of this programme include:

- avoiding or minimising disturbance to areas with or vulnerable to weed infestation;
- implementing vehicle hygiene measures, as required;
- inspecting all disturbed and rehabilitated areas for weeds (particularly after rainfall events) and treating infested areas;
- raising awareness in field personnel about weed control; and
- rehabilitating disturbed areas progressively to assist in reducing the spread of weeds.

Comments from key government agencies

The Department of Conservation and Land Management (CALM) provided the following comments:

"Commitment 3 (page 9-1) is to the development of a weed control and hygiene program. It is particularly important that the company control the spread of ruby dock at the Millstream crossover."

"CALM would like to have a copy of the flora list, if one is available. Details of the as yet unidentified species (page 4-8) would also be appreciated."

The Department of Minerals and Energy Western Australia (DOME) provided the following comments:

"Management of impacts of flora and fauna is not adequately addressed in this document, however the proponent has made a commitment to address these issues in its EMP (to be submitted prior to commencement of the project)."

The Australian Nature Conservation Agency (ANCA) provided a detailed submission which highlighted concerns about:

- the need for the proponent to undertake thorough field surveys of the flora and fauna in the region;
- the CER identifying the Ghost Bat (Macroderma gigas) as possibly occurring in or adjacent to the project area but not identifying its conservation status;

- the CER stating that as the vegetation and vertebrate species identified in the region have wide distributions throughout the Pilbara, they are not considered to be of particular significance. ANCA stated that such perceptions can be misleading however, as many widely distributed species are of conservation concern. ANCA also indicated that this statement could lead to the misconception that widely distributed species and communities are secure and need no attention paid to their conservation; and
- the CER identifying 11 species of migratory birds that may occur in the project area. ANCA indicated that all of these species are listed under the Japan-Australia Migratory Birds Agreements (JAMBA and CAMBA), in which Australia is obliged to protect the habitat for species listed under these agreements. ANCA also questioned whether or not the proponent's EMP would incorporate measures to minimise the impact on these migratory species, such as appropriate seasonal timing of construction activity and the use of environmentally sensitive plant lighting etc.

4.2.3 Public submissions

Public submissions expressed concern about why there was no fauna field survey conducted in the project area. One submission indicated that because the CER was not conclusive about future port use, all options for the review of port sites should have been included in the CER, and that this review should have included a flora study of Dixon Island. The desktop study of fauna species undertaken by the proponent was also considered to be inadequate for a proper environmental assessment.

4.2.4 Proponent's response

In response to the issues detailed in the public and government agency submissions, the proponent provided the following comments:

"It is common practice to undertake desktop studies rather than a field survey to assess the environmental impacts of a project on the fauna species and habitats of a project area where:

- there is a reasonable amount of existing information on the fauna of the coastal region;
- the fauna habitats in the project area are widespread throughout the region (ie. the habitats are unlikely to be restricted to the project area or regionally significant);
- the project area occurs in a wide zoogeographic region, and the fauna tends to be highly mobile and unlikely be dependent on the habitats in the project area; and
- the project is unlikely to cause significant disturbance to fauna species and habitats."

"Therefore, the approach adopted for the fauna study was to undertake a desktop study using the habitats identified during the flora and vegetation field surveys and the available literature for the area. Section 4.8.1 reported that no endemic species were likely to be limited to the project area or adjacent areas and would not be affected by the Project. It was also reported that the fauna habitats of the project area are not considered to have any unique qualities nor are they considered to be of special regional significance."

"A similar survey of the rail crossover also found that the project would not have a significant impact on the fauna of the area as they tend not to be habitat specific and have widespread distributions (Section 4.8.2 of the CER)."

"The results of the desktop studies and discussions with CALM and the Western Australian Museum indicated that it was not necessary to undertake field work to further investigate the fauna of the area."

"The Ghost Bat is protected under Schedule 1 and this was inadvertently omitted from the Appendix."

"The statement quoted from the CER was intended as a summary which stated that the flora and fauna of the Project area were widely distributed and common throughout the Pilbara. In

reaching this conclusion, the conservation status of species found (in the case of flora) and thought to be in the area (in the case of fauna) were taken into consideration as indicated within the CER. To not consider these issues, as suggested by the question, would be irresponsible."

"Table 4.6 of the CER and its associated notes identified the migratory birds that are protected by the JAMBA and CAMBA and may occur in the Project area. The comments provided within this table state that the Project area does not contain any major habitat suitable for 10 of these 11 species. The eleventh species, being the Rainbow Bee-eater, was also presented in Table 4.6 of the CER and is considered to be a resident, a winter visitor and a passage migrant in the Pilbara. It is moderately common throughout Western Australia and it is considered that the proposed development is unlikely to have a significant impact on its distribution or conservation status."

Commitments made by the proponent

With respect to flora and fauna, the proponent has made the following environmental commitments (refer to Appendix 5 for full list of commitments):

1. Prior to commencement of construction, the Proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment.
2. The Proponent will progressively rehabilitate disturbed areas to minimise disturbance of biological communities. The rehabilitation will be undertaken using best industry practice and will be completed to the reasonable satisfaction of the Minister for the Environment.
3. Prior to the commencement of construction, the Proponent will develop and implement a weed control and vehicle hygiene programme in consultation with CALM, the APB and other relevant DMA's and to the reasonable satisfaction of the Minister for the Environment. This programme will be included in the EMP.

4.2.5 Evaluation

Following advice from CALM, DOME and ANCA, and the proponents' response to questions raised, the EPA considers that this issue is potentially manageable. The EPA notes the commitments made by the proponent to rehabilitate disturbed areas and to develop and implement a weed control and vehicle hygiene programme in consultation with CALM and other relevant decision making authorities.

Notwithstanding the above, the EPA recommends (Recommendation 3) that the proponent should undertake a fauna field survey of the region, prior to the proposed plant being commissioned, with the view of appropriate rehabilitation as required and in order to quantify the results of the desktop study detailed in the CER.

Pollution issues

4.3 Protection of ground water and surface water

4.3.1 Objective

The Environmental Protection Authority's objective is to protect both ground water and surface water resources in order to prevent impacts to both the terrestrial and marine environments, including nearby mangroves, resulting from activities associated with the proposed DR/HBI Plant.

4.3.2 Evaluation framework

Existing policy framework

Meet the requirements of the Draft Western Australian Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711, October 1993).

Technical information

Ground water

The Town Planning Scheme for the Shire of Roebourne (Longbon, 1994) reports that ground water is generally available in the vicinity of Wickham and this water is only suitable for stock. The ground water is most readily obtained from alluvium along larger creeks and towards the base of colluvium and silty sand slopes. The alluvium often contains layers or lenses of calcrete from which bore yields of 100m³/day or more are possible. Elsewhere, bores are unlikely to yield more than 50m³/day. The water is usually at a depth of 5-15m and over most of the area the salinity is less than 5,000mg/L TDS and this increases near the coast.

Previous drilling in the Wickham town site area has encountered ground water ranging in salinity between 10,000mg/L TDS to over 30,000mg/L TDS (Barnett and Leech, 1978).

The CER stated that the Water Authority is currently undertaking a review of the Pilbara water resources and released an interim report in February 1995 (WAWA, 1995). This interim report does not list any known or likely significant ground water resources in the project area. The Geological Survey of Western Australia is currently undertaking a more detailed investigation of ground water resources in the region and these data will be presented in the final Pilbara water resource report.

The CER stated that the potential for the project to impact on the ground water is believed to be very small due to a number of factors including:

- the benign nature of the tailings which will contain only shale, low grade iron ore, and fresh water. No chemicals will be added during the concentration of the iron ore;
- the fines tailing ponds will be designed to facilitate water recovery;
- the expected low permeability of the tailings areas;
- the use of above ground, bunded fuel storage tanks; and
- the lack of any known ground water resource of any significance in the immediate vicinity of the project area.

The CER stated that based on the available data, the project is not expected to have any significant or unacceptable impacts on the ground water in the vicinity of the project area.

Surface water

The effects of the project on the surface hydrology of the project area are likely to include:

- the relocation of existing streams;
- modifications to existing channel hydraulic characteristics;
- changes to the erosion/sedimentation characteristics of the watersheds;
- changes in the stormwater runoff characteristics;
- potential flood plain alteration; and
- possible water quality degradation.

Relocation of Existing Streams

Construction of the plant facilities near the eastern boundary of the project area will necessitate relocating several existing streams. The extent of relocation will be dependent upon site development plans. Within the plant area, approximately 1km of existing streams will require reconstruction through or around the facilities.

Approximately 2km of streams will be inundated by the fine tailings impoundment. There are no plans for stream relocation.

The coarse tailings landfill is located adjacent to the main channels from both catchment areas, however the channel structure diverges into the flats at this point. The coarse tailings landfill will be constructed with erosion protection from stream flows and tidal inundation.

Changes to the existing streams and drainage patterns is an unavoidable and irreversible impact. Streams within each of the watersheds will be relocated to accommodate the site facilities and project land uses. Relocation criteria will incorporate increased flow rates and changed hydraulic conditions to protect the constructed facilities and downstream environment from adverse impacts. A monitoring program consisting of flow and sediment measurement will be established to assess the impact of drainage pattern modification. The programme will be designed to monitor the water quality of the principal tributary near the point where it leaves the site. The programme would be established to monitor total dissolved solids, total suspended solids, pH and conductivity. The monitoring would be undertaken periodically when the creek is flowing.

Modifications to Existing Streams

Relocation of the existing streams will result in changes to the hydraulic characteristics and will occur to accommodate buildings, roadways and facility structures. Based on the extent of relocation and site plans, the gradients, roughness coefficients, velocities and discharge characteristics will be affected.

Within the two tailings storage areas, the existing drainage will be covered by tailings and will not be subject to modifications. In the case of the fine tailings area, a series of dams will be constructed to contain the tailings. Downstream drainage conditions and channel discharges will be a function of the impoundment size. This will also impact the hydraulic conditions of the channels downstream of the impoundment. Given the available storage within the fine tailings impoundment it is unlikely that downstream peak flows during storm events will increase.

As part of stream relocation and altered drainage patterns, physical changes to the streams will be required. For those outside the tailings storage areas, the modifications will duplicate the existing streams as much as possible. Channel gradients, stream bank slopes and roughness factors will be established to provide conveyance capacities sufficient to meet peak flows resulting from the 50-year flood event. Low flow channels will also be provided to minimise low flow sedimentation and erosion impacts.

It was stated in the CER that structural improvements such as bridge and culvert crossings will be designed to convey the 50-year flood peak flow.

Erosion and Sedimentation

Construction activities within all watersheds will increase the potential for short term soil erosion and sedimentation within the existing channels. This will in turn impact the hydraulic characteristics of the channels. Relocation and modification of the channels will impact the state of equilibrium of each stream. Aggradation and degradation may occur causing changes to the stream channels both within and downstream of the project area.

Erosion and sedimentation impacts mitigation will consist of both short term and long term activities. On a short term basis, erosion control activities will be implemented during construction. Those will consist of revegetation, installation of silt fences, diversion channels and construction of sediment control impoundments.

On a long term basis, erosion control activities will be focused within the coarse tailings watershed and the plant area. Sedimentation ponds will be the primary means of erosion and sedimentation control. The ponds will be located off channel where topographic conditions permit and will be designed for the 10-year, 24 hour storm event. Designs will also incorporate a minimum removal of efficiency of 50 percent, a length to width ratio of at least 3 to 1, and a length to depth ratio of 100 to 1. Embankments for the impoundments will have minimum slopes of 2.5 horizontal to 1 vertical and will include both principal and emergency spillways.

The CER stated that the success of sedimentation ponds will depend upon the retention time and the characteristics of the particles in the water (eg. size and density). In addition to the

sedimentation ponds, the Proponent will undertake additional measures to reduce off-site transport of sediments including:

- minimising the extent and duration of land disturbance and vegetation clearing;
- progressively rehabilitating disturbed areas; and
- identifying and treating those areas with high erosion potential.

Stormwater Runoff

Construction of plant facilities will increase the amount of impervious area and may decrease the time of concentration for stormwater run-off. This may result in a higher volume of run-off and higher peak flows. Depending on the site development plans, the developed two-year peak flow and run-off volume may actually increase to the five-year or greater event corresponding to existing conditions. This will impact the channel conveyance capacity and the sediment conveyance equilibrium.

Similarly, the tailings storage will change the hydrologic response of each watershed. Steeper slopes and less vegetation will increase the hydrologic response times and peak flows.

Due to land use changes, this is considered an unavoidable and irreversible impact. Mitigation will consist of modelling each watershed for both short term and long term project conditions. Flow rates and volumes from those analyses will be used to size new channel sections, bridges and culvert crossings, and design of erosion control features.

Stormwater runoff impacts upstream and downstream of the fine tailings storage area will result from impoundment construction. The CER indicated that mitigation will consist of containment of rainfall runoff within the impoundment. The downstream flow regime and channel will also be monitored for both aggradation and degradation.

Flood Plain Changes

Due to channel relocation and changes to each watershed hydrologic response, it is probable some changes to the floodplain will occur. These however, will generally occur within the project area as controlled by any bridges, culverts or structures constructed as part of the site facilities development. The fine tailings impoundment will result in some floodplain changes within and outside of the project area.

Should a dam break occur, the floodplain downstream of the wall will be affected. This impact will likely be not significant given the lack of structures and inhabitants adjacent to the downstream tributaries. Upstream of the fine tailings impoundment, floodplain changes will occur as a result of dam construction.

Changes to the floodplain both within the project area and the downstream reaches of the tributaries are expected to be minor. Floodplain limits within the project area will be controlled by the stream crossing and any channel or bridge improvements constructed as part of the site development.

The CER stated that the fine tailings embankments will be designed to prevent failure with a factor of safety exceeding 1.5 and that containment will be provided to prevent dam overtopping.

Water Quality Degradation

The CER indicated that potential runoff water quality impacts are most unlikely as a result of chemical spills and discharges from the plant facilities and surface water runoff contact with the coarse and fine tailings.

Based on the process description detailed in the CER, the tailings are considered to be inert and will not affect surface water quality. Impacts due to erosion and sedimentation will be mitigated by construction of sedimentation ponds and other erosion control practices.

The CER stated that plant facilities will include containment measures to protect the surface waters from spills and process chemical discharges.

Comments from key government agencies

The Department of Environmental Protection (DEP) carried out a technical evaluation of the information presented in the CER relating to the protection of ground water and surface water, and detailed the following concerns:

- the potential impact on mangroves from changes to the local ground water regime (ie. salinity, flowrates and flow directions etc) due to the presence of tailings dams near the coast and how this potential impact would be managed;
- how the proponent intended to ameliorate potential impacts during construction as a result of contaminants being present in surface runoff;
- the monitoring of ground water quality at the perimeter of the DR/HBI plant and its associated tailings dams and whether or not the proponent was prepared to make a commitment to undertake such monitoring; and
- the erosion of tailings dam walls through gullying and piping as a result of extreme rainfall events and/or poor tailings management over a period of time and how the proponent would manage this potential impact.

The DEP also stated that, "the quantity of water exported via the concentrator tailings is 1.32Mm^{3}pa or 40% of total fresh water usage. A water volume of 0.73Mm^3 or around 24% of all scheme water is lost through evaporation from the tailings. There is no target set for the recovery of water from the tailings and no statement in the report on what is best practice technology for water recovery. The Executive Summary says that a Water Management plan is to be, or has been developed, but there is no specific section or commitment on this in the main report. Water resource development is a critical environmental issue in the region."

The Department of Conservation and Land Management expressed the following concern:

"There is some concern regarding the position of the tailings dam with respect to storm surge. The possibility of storm surge occurring in the area of the dams is recognised in the CER, and rock armouring of the dams is proposed (pages 3-17). Changing the siting of the dams to outside the storm surge limits may be a preferable alternative, and should be considered."

The Department of Minerals and Energy Western Australia expressed the following concerns:

"The revised CER addresses most of the queries made following the Department's review of the draft CER, however there is are still some outstanding issues, viz:

- tailings storage details (it is assumed this will be covered at a later date in another document or in the EMP); and
- surface hydrology management issues are only broadly discussed and the proponent has stated that they will address these issues further in the EMP."

The Water Authority of Western Australia expressed the following concerns:

"Although the WAWA recognises that there will be some changes in the surface drainage pattern due to the relocation of existing streams, the Authority considers that this will not have any significant impact on receiving waters."

"The Authority therefore would accept the proposal subject to the Proponent's commitment that 'the Proponent will establish a programme to periodically monitor total dissolved solids, total suspended solids, pH and conductivity in the principal tributary prior to its discharge' (Commitment 4) (refer section 7.5.1). It is unclear, from the statement 'prior to its discharge', what the proposed discharge point will be."

"The proposal did not address management strategies on Water Conservation. The WAWA, therefore, believes that a commitment should be made by the proponent for the adoption of an auditable water Efficiency and Conservation programme. The WAWA believes that this issue should be addressed at the planning and construction stage of the project and not during the operational phase."

"The WAWA recommends that a commitment; 'the proponent will design and develop a management programme to ensure that water is conserved and used in a most efficient manner', be included."

"The WAWA considers that, although the project will not have any significant impact on terrestrial water resources during its operation, pollution prevention measures may be required to minimise or ameliorate likely environmental impacts during construction as a result of contaminants that may be present in surface runoff."

4.3.3 Public Submissions

One public submission expressed concern about references in the CER to the proponent obtaining water from WAWA or through development of the Fortescue borefield. It was stated that there are environmental considerations attached to the potential borefield and associated pipeline from further development. It was suggested that additional information should be obtained from the proponent on this matter, in order for it to be assessed in the overall context of the project.

The Conservation Council of Western Australia Inc expressed the following concerns:

"The Council is concerned about the environmental impacts of changes to surface hydrology in the area. The CER has not provided enough detail on possible impacts on ecosystems in the area due to changed hydrology, sedimentation etc. The CER does not adequately address the predicted increase in rainfall and cyclonic events due to the Greenhouse Effect."

"We do not consider it appropriate that tidal flats are used for tailings storage, tidal flats in the Pilbara region are very important and should not be used for such activity. Why has the site been chosen? Why wasn't a land based site chosen? Possible impacts of the dam include loss of habitat, loss of mangroves and disturbance to drainage patterns."

4.3.4 Proponent's response

In response to the concerns expressed in the above government agency and public submissions, the proponent provided the following comments:

"The AUSI Iron Project now only requires the fine tailings dam. Section 7.8 of the CER stated that the potential of the project to impact on the ground water is small as a result of:

- the benign nature of the tailings which will contain only shale, low grade iron ore and fresh water. No chemicals will be added during the concentration of the iron ore;
- the design of the fine tailings pond, which will facilitate water recovery;
- the expected low permeability of the tailings areas; and
- the lack of any known ground water resource of any significance in the immediate vicinity of the area."

"The tailings dam will not be designed to stop leakage, although every reasonable effort will be made to maximise the recovery of water from the dam. Leakage from the fine tailings dam is not expected to result in any unacceptable impacts on the mangroves in the area. The water from any leakage will essentially be fresh as no chemicals are added during the concentration process. As such, any leakage will not contain any significant contaminants or nutrient loadings."

"It is considered unlikely that the tailings dam will result in a rise in the ground water table due to:

- the low volume of water discharged into the dam;
- the recovery of excess water for re-use in the process; and
- the high evaporation rate."

"It is therefore concluded that the Project will not result in any significant or unacceptable changes to the ground water regime or the mangrove communities in the vicinity of the project area. As such, monitoring will not be required."

"Section 7.5 of the CER discusses the potential impacts of the Project on the surface hydrology of the project area. While the management measures discussed within this section primarily relate to the operational stage of the plant, they will also be applied to the construction phase of the project where practical. In particular, the impacts due to erosion and sedimentation will be mitigated by construction of sedimentation ponds and other erosion control procedures."

"AUSI is very aware that water is a valuable resource in the Pilbara region. As a direct result, the Project has been designed to minimise its consumption of water and details of these methods are presented within Section 3.11 of the CER. For example, the HBI plant has been designed to reduce the freshwater consumption from approximately 1.5m^3/t HBI for conventional HBI plants with freshwater evaporative cooling towers to less than 0.5m^3/t HBI for the proposed plant."

"However, as water is a valuable resource, AUSI would be happy to carry out an auditable water efficiency and conservation programme relating to its usage of fresh water."

"The proposed location and configuration of the discharge point is currently unknown as the detailed engineering design of the plant is not yet completed. It is planned that the surface water discharge from the site will occur via existing streams, where possible. Therefore, it is likely that the monitoring programme would be undertaken within existing streams towards the edge of the Project Area and downstream of the sedimentation ponds."

"AUSI will make a commitment to monitor the ground water quality at the perimeter of the "Plant area and the fine tailings dam as follows:

Prior to commissioning, the Proponent will establish a ground water monitoring programme to record the water quality and depth of the water table at the perimeter of the Plant area and the fine tailings dam. The monitoring programme will be designed to monitor water quality both upstream and downstream of the tailings dam on a quarterly basis. The monitoring programme would be designed and implemented to the reasonable satisfaction of the Minister for the Environment."

"AUSI is committed to progressively rehabilitating disturbed areas (including the tailings dam) to facilitate erosion control and revegetation (Section 7.18 of the CER). In addition, AUSI is committed to minimising the off-site transport of sediments through the use of sedimentation ponds, the minimisation of exposed surfaces and identification and treatment of on-site areas with erosion potential (Commitment 5). This commitment will apply to the tailings dam."

Commitments made by the proponent

With respect to the protection of ground water and surface water, the proponent has made the following environmental commitments (refer to Appendix 5 for full list of commitments):

4. The Proponent will establish a programme to monitor total dissolved solids, total suspended solids, pH and conductivity in the principal tributary prior to its discharge from the site. This programme will be designed prior to the commencement of construction and will be implemented periodically during the construction and operational phases, to the reasonable satisfaction of the Minister for the Environment.

5. The Proponent will minimise the off-site transport of sediments through the use of sedimentation ponds, the minimisation of exposed surfaces and identification and treatment of on-site areas with erosion potential. This will be carried out to the reasonable satisfaction of the relevant DMA's and the Minister for the Environment.

14. Prior to the construction of the tailings dams, the Proponent will undertake geotechnical investigations and will design and operate the dams to meet the reasonable requirements of DOME and the Minister for the Environment.

24. Prior to commissioning, the Proponent will establish a ground water monitoring programme to record the water quality and depth of the water table at the perimeter of the

Plant area and the fine tailings dam. The monitoring programme will be designed to monitor water quality both upstream and downstream of the tailings dam on a quarterly basis. The monitoring programme would be designed and implemented to the reasonable satisfaction of the Minister for the Environment.

4.3.5 Evaluation

Following advice from the Department of Environmental Protection (DEP), CALM, DOME and WAWA, and the proponent's response to questions raised, the EPA considers that this issue is potentially manageable. The EPA notes the above commitments made by the proponent and acknowledges the fact that the proponent no longer requires the coarse tailings dam, thereby eliminating any potential impacts that may have been associated with it.

Notwithstanding the above, the EPA recommends that, in addition to the commitments made by the proponent, the proponent's Environmental Management Programme (EMP) should provide the following information with respect to the protection of ground water and surface water, to the satisfaction of the Environmental Protection Authority on advice from the DEP (Recommendation 2):

- the control of surface water, runoff, drainage and tailings dam such that the ground water is protected;
- a rehabilitation plan and closure strategy for the tailings dam;
- a water efficiency and conservation programme relating to the usage of fresh water; and
- a monitoring and audit programme for ground water and surface water quality at and around the plant and tailings dam, with particular emphasis on iron as an indicator.

The EPA also recommends (Recommendation 2) that reports of the results of the monitoring programme should be submitted at appropriate times to the DEP for audit and that they should be made publicly available.

4.4 Gaseous emissions (including greenhouse gases and odours)

4.4.1 Objective

The Environmental Protection Authority's objective is to ensure that gaseous emissions, including greenhouse gases and odours, both individually and cumulatively, do not cause environmental or human health problems.

4.4.2 Evaluation framework

Existing policy framework

The Environmental Protection Authority has adopted the following provisional policy on greenhouse gases.

(a) proponents are required to calculate the greenhouse gas emissions associated with their proposals (using appropriate methodology developed for Australia);

(b) proponents are required to estimate the international offsets achieved by the implementation of their proposal;

(c) proponents are required to indicate the "no regrets" measures adopted to reduce greenhouse gas emissions; and

(d) proponents should enter into a voluntary agreement with the state which includes annual estimation of greenhouse gases, commitments to implement "no regrets" measures and approaches to abate greenhouse gas emissions and enhance sinks.

Western Australia does not have any state-wide regulatory ambient standards for sulphur dioxide, nitrogen dioxide and hydrogen sulphide. The DEP and EPA base environmental acceptability on the criteria established by other authorities such as the National Health and Medical Research Council (NH&MRC), Victorian EPA (VEPA), United States Environmental Protection Agency (USEPA) and World Health Organisation (WHO).

In the case of sulphur dioxide, the EPA generally uses the ambient standards that are part of the Environmental Protection Policy (EPP) for Kwinana which was promulgated by the State Government on 17 July 1992 as criteria. Under this EPP, the EPA has set ambient standards and limits for sulphur dioxide for three air quality policy areas at Kwinana which are:

- Area A - used mostly for industrial purposes;
- Area B - a buffer zone between industry and residential use; and
- Area C - the area beyond the buffer zone.

Industry is required to aim at controlling its emissions to produce air quality better than the standard while the limit should never be exceeded.

Tables 3, 4 and 5 present a summary of the ambient air quality guidelines for sulphur dioxide, nitrogen dioxide, particulates and hydrogen sulphide, respectively. In all of these tables the maximum predicted ground level concentrations are expressed as micrograms per cubic metre ($\mu g/m^3$) at standard temperature and pressure (STP - 0°C, 1013.23 hPa).

TABLE 3

KWINANA EPP AMBIENT STANDARDS AND LIMITS FOR SULPHUR DIOXIDE

	Standard ($\mu g/m^3$)			Limit ($\mu g/m^3$)		
	1-Hour Average	24-Hour Average	Annual Average	1-Hour Average	24-Hour Average	Annual Average
Area A	700	200	60	1,400	365	80
Area B	500	150	50	1,000	200	60
Area C	350	125	50	700	200	60

Note: 1. Kwinana EPP 1992.

TABLE 4

AMBIENT GUIDELINES FOR NITROGEN DIOXIDE

Authority	Averaging Period Concentration ($\mu g/m^3$)		
	1-hour	24-hour	Annual
NH&MRC	320		
USEPA			100
VEPA Acceptable (not to be exceeded on more than 3 days)	308	112	
VEPA Detrimental (never to be exceeded)	513	282	
WHO	400	150	

Notes: NH&MRC National Health and Medical Research Council.

USEPA United States Environment Protection Agency.

VEPA Victoria Environment Protection Authority.

WHO World Health Organisation.

TABLE 5
AMBIENT GUIDELINES FOR HYDROGEN SULPHIDE

Authority	Averaging Period Concentration (µg/m³)		
	Instantaneous	3-minute	30-minute
WHO			7
NSW EPA	7	1.4	
VEPA		0.14[1]	

Notes: NSW EPA New South Wales Environment Protection Authority.

1. 3-minute design criteria.

The following criteria were selected by the proponent and the EPA for assessing the predicted ground level concentrations resulting from the proposed DR/HBI plant:

- sulphur dioxide: 1-hour standard of 350µg/m³;
- nitrogen dioxide: 1-hour average concentration of 308µg/m³;
- particulates: 24-hour average concentration of 150µg/m³; and
- hydrogen sulphide: 3-minute average concentration of 1.4µg/m³.

The selected standards generally represent the most stringent of the criteria presented in Tables 3-5. The exception to this is the criterion chosen for hydrogen sulphide. In the case of hydrogen sulphide, the NSW EPA guideline was selected by the proponent in preference to the VEPA guideline, after consultation with the DEP.

The CER stated that when assessing the acceptability of the predicted ground level concentrations, the DEP sometimes utilises the 9th highest predicted 1-hour average concentration (i.e. the 99.9 percentile) to compare to the standard. The modelling results presented within the CER represent the maximum predicted ground level concentrations which further adds to the conservative nature of the predictions.

Technical information

Sulphur Dioxide

The estimated emission rates of sulphur dioxide and the associated emission characteristics for each source associated with the DR/HBI plant were presented in Section 3.7 of the CER.

The MAXMOD worst-case air dispersion model was utilised to predict the maximum impact of the pellet plant emissions in isolation. The pellet plant accounts for approximately 56% of the total plant emissions of sulphur dioxide under normal operating conditions. The maximum predicted 1-hour average concentration resulting from the pellet plant sulphur dioxide emissions was 81µg/m³. This maximum was predicted to occur at approximately 1.1km from the source in A class stability with light winds. This concentration is less than one quarter of the suggested guideline of 350µg/m³.

The ISCST air dispersion model was used in conjunction with the annual meteorological data set to predict the maximum 1-hour, 24-hour and annual averaged concentrations over the model grid and the discrete hill-top receptors. Table 6 presents a summary of the maximum concentrations predicted over the model grid, within Wickham (the closest residential area) and at the top of the surrounding hills.

TABLE 6
MAXIMUM PREDICTED GROUND LEVEL CONCENTRATIONS OF SULPHUR DIOXIDE - NORMAL OPERATING CONDITIONS

Location	Maximum Predicted Concentration ($\mu g/m^3$) for each Averaging Time		
	1-Hour	24-Hour	Annual
Model Grid	67.6	6.6	0.7
Wickham	9.7	3.7	0.4
Surrounding Hill Tops	154.5	33.1	2.0

The ISCST model was also utilised to predict the ground level concentrations resulting from each of the identified upset conditions. The maximum predicted concentrations from all of the scenarios are presented in Table 7.

All of the maximum predicted concentrations presented in Tables 6 and 7 are well below the criteria presented in Table 5. The highest concentrations of sulphur dioxide were generally predicted to occur during normal operating conditions.

The maximum short-term sulphur dioxide concentrations were predicted to occur on the top of the surrounding hills. The maximum 1-hour concentration in these areas is predicted to be approximately one half of the ambient guideline.

The maximum 1-hour concentrations of sulphur dioxide predicted in Wickham are less than one thirtieth of the residential standard of $350\mu g/m^3$.

TABLE 7
MAXIMUM PREDICTED GROUND LEVEL CONCENTRATIONS OF SULPHUR DIOXIDE - UPSET CONDITIONS

Location	Maximum Predicted Concentration ($\mu g/m^3$) for each Averaging Time		
	1-Hour	24-Hour	Annual
Model Grid	48.8	12.7	1.3
Wickham	15.4	5.0	0.6
Surrounding Hill Tops	104.2	24.0	1.7

The CER stated that the emission rates of sulphur dioxide under normal and upset conditions were within acceptable levels. The maximum predicted 1-hour average concentrations are well below the proposed objective of $350\mu g/m^3$.

The CER also indicated that most sulphur dioxide emitted by the proposed DR/HBI plant would originate from sulphur in the iron ore. The sulphur dioxide emission rates were determined using a worst case iron ore sulphur content of 0.02%, hence the actual sulphur dioxide emissions from the project should be lower than those used in the modelling.

The diesel fuel used as backup for power generation will also be a source of sulphur dioxide emissions. The CER stated that AUSI would, wherever possible, utilise diesel with a sulphur content less than or equal to 0.5% in order to reduce the emissions of sulphur dioxide from this source.

Nitrogen Dioxide

The emissions of oxides of nitrogen (NO_x) from the proposed DR/HBI plant are primarily a product of combustion. These emissions will be a mixture of nitrogen dioxide (NO_2) and nitric oxide (NO).

Nitrogen dioxide is a primary pollutant and, as such, of concern in relation to ground level concentrations. Nitric oxide is generally oxidised to nitrogen dioxide via a reaction with ozone as the plume is dispersed downwind. If non-methane hydrocarbons (NMHCs) and/or volatile organic compounds (VOCs) are present, they can form reactive radicals in the presence of sunlight (by photo-disassociation) which can also oxidise nitric oxide and not consume ozone. The oxidation of nitric oxide by reactive radicals can result in a significant production of ozone, the principal component of photochemical smog. Although no monitoring data are available for the area it is most unlikely that photochemical smog currently represents any risk in the area.

The percentage of nitrogen dioxide as a function of the total emissions of oxides of nitrogen (NO_2/NO_x) is dependent upon a large number of factors (e.g. combustion process and capacity) and can vary significantly from source to source. It is generally accepted that combustion processes result in a NO_2/NO_x ratio of 5-10% (SECWA, 1990; Bowman, Bishaw & Gorham, 1990). Manins (1990) utilised a maximum NO_2/NO_x ratio of 20% for modelling gas turbine emissions, although figures as low as 1.6% have been quoted by manufacturers and observed by direct measurement (SECWA, 1993 pers. comm.).

Therefore, the ground level concentrations of nitrogen dioxide experienced in any area are a function of:

- the background concentrations of nitrogen dioxide;
- the emission rate of oxides of nitrogen;
- the initial NO_2/NO_x ratio;
- the rate of oxidation of nitric oxide to nitrogen dioxide;
- the prevailing meteorological conditions; and
- photochemical reactions.

The CER stated that reaction models have been created that can predict the rate of oxidation of nitric oxide to nitrogen dioxide (eg. Manins, 1990). However, such modelling was not undertaken for this study as monitoring data for the existing ozone, hydrocarbon and nitrogen dioxide concentrations were not available.

Smith (1980) reported an oxidation rate which ranged from 0% at the source to a maximum of 40% at a distance of 20km downwind. Therefore, if the initial NO_2/NO_x ratio of the emission was 20% then the NO_2/NO_x ratio estimated from Smith's work at 20km downwind would be approximately 52%. BHP (1994) utilised a NO_2/NO_x ratio of 50% for its modelling of the oxides of nitrogen emissions from its proposed HBI project. On the basis of these two reports a NO_2/NO_x ratio of 50% was assumed for this study.

The estimated emission rates of oxides of nitrogen (as nitrogen dioxide) and the associated emission characteristics for each source associated with the DR/HBI plant were presented in Section 3.7 of the CER.

The MAXMOD worst-case air dispersion model was utilised to predict the maximum impact of the Reformer flue plant emissions in isolation. This source accounts for approximately 64% of the total plant emissions of oxides of nitrogen under normal operating conditions. The maximum predicted 1-hour average concentration of nitrogen dioxide resulting from the Reformer flue oxides of nitrogen emissions was 128µg/m^3. This maximum was predicted to occur at approximately 1.1km from the source in A class stability with light winds and is less than half of the suggested guideline of 308µg/m^3.

The ISCST air dispersion model was used in conjunction with the annual meteorological data set to predict the maximum 1-hour, 24-hour and annual averaged concentrations of nitrogen dioxide over the model grid and the discrete hill-top receptors. Table 8 presents a summary of the maximum concentrations predicted over the model grid, within Wickham (the closest residential area) and at the top of the surrounding hills.

TABLE 8
MAXIMUM PREDICTED GROUND LEVEL CONCENTRATIONS OF NITROGEN DIOXIDE - NORMAL OPERATING CONDITIONS

Location	Maximum Predicted Concentration ($\mu g/m^3$) for each Averaging Time		
	1-Hour	24-Hour	Annual
Model Grid	79.6	21.9	2.2
Wickham	38.5	8.2	1.1
Surrounding Hill-Tops	81.0	23.9	2.6

The ISCST model was also used to predict the ground level concentrations resulting from each of the identified upset conditions. The maximum predicted concentrations from all of the scenarios are presented in Table 9.

TABLE 9
MAXIMUM PREDICTED GROUND LEVEL CONCENTRATIONS OF NITROGEN DIOXIDE - UPSET CONDITIONS

Location	Maximum Predicted Concentration ($\mu g/m^3$) for each Averaging Time		
	1-Hour	24-Hour	Annual
Model Grid	80.7	22.0	2.2
Wickham	39.6	8.3	1.1
Surrounding Hill-Tops	82.5	24.0	2.6

All of the maximum predicted concentrations presented in Tables 8 and 9 are well below the criteria presented in Table 4. The highest concentrations of nitrogen dioxide were generally predicted to occur during a short term shutdown of all three DR shafts. Under these conditions, all of the DR shaft emissions are dumped to the flare. The frequency of this type of event occurring has been estimated to be 3 times per year for a maximum of 12 hours per event.

The maximum short-term nitrogen dioxide concentrations were predicted to occur at the top of the surrounding hills. However, the maximum 1-hour concentration in these areas is predicted to be approximately one third of the ambient guideline.

The maximum 1-hour concentrations of nitrogen dioxide predicted in Wickham are less than one seventh of the proposed guideline of $308\mu g/m^3$.

The CER stated that the emission rates of nitrogen dioxide under normal and upset conditions are not predicted to result in any unacceptable levels of impact. The maximum predicted 1-hour average concentrations are well below the proposed objective of $308\mu g/m^3$.

The air dispersion modelling study indicated that the nitrogen dioxide emissions result in predicted ground level concentrations within the criteria presented in Table 4. Emissions of oxides of nitrogen from the power station will be reduced through the use of best practicable technology such as dry-low NO_x burners. The technology used would ensure that the emissions of oxides of nitrogen from the power station do not exceed $0.07g/m^3$ (expressed as NO_2 at 0°C, 101.3kPa, 15% oxygen, dry) which is the current NHMRC guideline for gas turbines of this size (NH&MRC National guidelines for control of emission of air pollutants from new stationary sources {1985}).

Hydrogen Sulphide

The CER indicated that hydrogen sulphide is likely to be discharged from the depressurising scrubber and the carbon dioxide scrubber stacks. The estimated emission rates of hydrogen sulphide and the associated emission characteristics for these sources were presented in Section 3.6.2 of the CER.

The MAXMOD worst-case air dispersion model was utilised to predict the maximum impact of the DR/HBI plant emissions in isolation. For the purpose of this model run, the hydrogen sulphide emission rate from all three of the direct reduction shaft furnaces were combined and modelled using the emission characteristics of a single source. The CER stated that the combination of sources in this manner would result in a conservative estimate of the ground level concentrations as the source separation and enhanced buoyancy effects have been ignored. The direct reduction shafts account for approximately 69% of the total project emissions of hydrogen sulphide under normal operating conditions. The maximum 1-hour average concentration of hydrogen sulphide predicted for this case was 0.9µg/m^3 and was predicted to occur at approximately 1.1km from the source in A class stability with light winds. The 3-minute average hydrogen sulphide concentration, estimated from the predicted 1-hour concentration using the relationship presented by Hanna *et al.* (1977), is 1.6µg/m^3 and this is marginally greater than the proposed guideline of 1.4µg/m^3.

The ISCST air dispersion model was used in conjunction with the annual meteorological data set to predict the maximum 3-minute average concentration of hydrogen sulphide over the model grid and the discrete hill-top receptors. Table 10 presents a summary of the maximum concentrations predicted over the model grid, within Wickham (the closest residential area) and at the top of the surrounding hills. The maximum 3-minute average hydrogen sulphide concentration predicted by ISCST2 for the model grid was 5.9µg/m^3 which is greater than the proposed guideline. The maximum 3-minute average hydrogen sulphide concentration predicted in Wickham was 0.3µg/m^3, or less than one quarter of the proposed guideline.

TABLE 10

MAXIMUM PREDICTED GROUND LEVEL CONCENTRATIONS OF HYDROGEN SULPHIDE - NORMAL OPERATING CONDITIONS

Location	Maximum Predicted 3-Minute Average Concentration (µg/m^3)
Model Grid	2.3
Wickham	0.3
Surrounding Hill-Tops	5.9

The upset conditions that have been identified all emit less hydrogen sulphide than the normal operating scenario as the process gases are directed to the flare where the hydrogen sulphide would be oxidised to sulphur dioxide. The sulphur dioxide emissions that occur under this scenario have been included in the modelling presented in Section 7.6.5 of the CER.

The CER indicated that emission rates of hydrogen sulphide were predicted to result in ground level concentrations in excess of the proposed guideline for areas close to the source. However, the maximum concentrations in the closest residential area (Wickham) were predicted to be less than one quarter of the suggested guideline. The modelling undertaken assumed that 30% lump ore would be used in the direct reduction shaft furnaces and that its sulphur content is 0.02% (ie. the maximum likely). This is the maximum level of lump ore that would be used and, therefore, the actual emission rate of hydrogen sulphide is likely to be less than that used in the modelling.

The CER stated that the usage of dimethyl disulphide and the resultant concentration of hydrogen sulphide in the reformer gas stream would be monitored to minimise its usage.

The emissions of hydrogen sulphide from the direct reduction shafts are derived from the sulphur contained in the lump ore. The hydrogen sulphide emissions are partially (approximately 98%) incinerated prior to being discharged to minimise the total emission rate.

Greenhouse gas emissions

The CER stated that in 1990, it was estimated that the total worldwide emission of carbon dioxide was 28.3Gt/year. At that time Australia's emissions of carbon dioxide were estimated to be 0.4Gt/year or 1.4% of the global total. SECWA (1990b) estimated that Western Australia contributes approximately 0.1% of the worldwide carbon dioxide emissions.

It is estimated that the proposed project, operating at a maximum production rate of 3.6Mtpa would emit a total of 2.8Mtpa of carbon dioxide. This equates to an increase of about 0.7% in the total emissions of carbon dioxide estimated for Australia in 1990.

One of the major mechanisms used to reduce greenhouse gas emissions is to increase energy efficiency. The proposed DR/HBI plant has been designed to maximise the effective usage of energy with the major energy efficient features being:

- the pellet plant recovers the burner off-gases for use in the drying and pre-heating stages;
- the direct reduction shaft and HBI process recovers heat from the reformer flue gas and recycles it to the reformer by using it to pre-heat the reformer combustion air and the process gas which is reformed and sent to the shaft furnace; and
- gas based direct reduction processes are generally highly energy efficient as they produce metallic iron without using energy to melt the iron which occurs in the smelting process.

The CER stated that the high energy efficiency of the Project would minimise the emissions of carbon dioxide and that they would be considerably lower than the emissions generated by the traditional technologies (such as blast furnaces) used to produce iron.

The CER indicated that the project would minimise its emissions of greenhouse gases through the efficient use of energy and waste heat recovery.

Comments from key government agencies

The Department of Environmental Protection (DEP) carried out a technical evaluation of the information presented in the CER relating to gaseous emissions (including greenhouse gases) and odours, and detailed the following concerns:

- the DEP stated that the sulphur content of iron ore varies considerably depending on the location of its source and that this may affect the predicted levels of SO_2 and H_2S emissions from the DR/HBI plant. The DEP requested that the proponent provide some indication of the sulphur content its supplied iron ore would have in the medium to long term and how changes in sulphur content will be accommodated;
- the DEP advised that, with the possible exception of hydrogen sulphide, it is very unlikely that the gaseous emissions from the plant will have an unacceptable impact on Wickham or other places of human residence;
- the DEP highlighted the fact that there was no suitable climatic data available for the project area to allow accurate modelling to be performed and questioned how the proponent could guarantee that air emissions from the DR/HBI plant would not exceed recommended guideline levels. The DEP also expressed concern about what corrective measures would be implemented by the proponent if these guideline levels were exceeded once the operations commenced;
- the DEP indicated that there was likely to be strong local community objection to black smoke emanating from flaring operations at the plant. The DEP expressed concern as to whether the proponent had given appropriate consideration to designing flaring systems for smokeless operation even under upset conditions;
- the DEP stated that the proposed DR/HBI plant would generate large amounts of CO_2 and questioned whether or not the proponent had given consideration to addressing the potential greenhouse effects of CO_2 emissions from the plant through means such as sink

compensation for source generation. The DEP also questioned whether or not the proponent was willing to make a commitment to do so; and

- the DEP also stated that in order to minimise the risk of having to carry out expensive modifications or overhauls of the plant in the future, the proponent should ensure that a best practice approach is taken on all emission concentrations, and that the plant is designed in a way which allows for substantial lowering of emissions in the future. The DEP also stated that it would have been preferred if a zero emission goal was used as the basis for the plant proposal. Limitations on achieving that goal should then have been outlined in some detail in the CER.

The Department of Minerals and Energy WA (DOME) expressed concern about the accuracy of information on SO_2 emission rates that was presented in Sections 3.2.2, 3.6.2, 3.7.1 and 7.6.5 of the CER. DOME indicated that any discrepancy in the amount of SO_2 produced could affect the maximum predicted ground level concentrations of SO_2 and suggested that the proponent clarify this information. DOME also sought clarification from the proponent about how and why the predicted ground level concentration of SO_2 under normal conditions was higher than under upset conditions.

4.4.3 Public submissions

One submission stated that since westerly winds predominate for a large part of the year, gaseous emissions would be pushed over the town of Wickham. This same submission expressed concern about what contingency plans would be put in place to accommodate abnormal or upset conditions in the plant. Additional concern was detailed about whether the proponent would monitor ground level concentrations near Wickham and shut the plant down if they increased above acceptable limits.

4.4.4 Proponent's response

In response to the issues detailed in the government agency and public submissions, the proponent provided the following comments:

"The emissions of sulphur dioxide are proportional to the sulphur content of the iron ore. The emissions of hydrogen sulphide will depend to a large extent upon the chosen Direct Reduction technology (Midrex or HYL). If HYL is chosen, then the emissions of hydrogen sulphide will also increase due to the increased sulphur into the system."

"The air dispersion modelling has been undertaken using the maximum expected sulphur content in the iron ore (0.02%). Therefore, the predicted impacts of sulphur dioxide and hydrogen sulphide are likely to be conservative."

"The supplier of the iron ore will have a contractual agreement with AUSI to ensure that the iron ore is within the required specifications. These specifications will include the sulphur content."

"Table 3.1, presented in Section 3.0 of the CER states that the expected range of sulphur in the ore is 0.01 to 0.02%. The medium sulphur content of the fine and lump ore is 0.016% and 0.011% respectively."

"Modelling was conducted using the maximum expected sulphur content (ie. 0.02%). Therefore, the predicted impacts are likely to be conservative as the actual sulphur content of the ore is generally expected to be less than 0.02% based on the average sulphur content of less than 0.016% (depending upon the ore type)."

"Section 7.6.4 of the CER stated that the meteorological data used for the modelling was not ideally suited for this use. However, no better site specific data could be obtained for use in this study. As a result of the inadequacies of the meteorological data, a number of different models were used to predict the ground level concentrations of pollutants over the full range of expected meteorological conditions. With the exception of the predicted concentrations of hydrogen sulphide, all of the predicted ground level concentrations were well below the recommended

criteria. Based on the conservative nature of the modelling together with the use of the maximum expected emission rates, it was concluded that the air quality impacts of the plant would be acceptable."

"In the event that the guideline levels presented within the CER are exceeded in residential areas as a result of the AUSI Iron Project, AUSI will modify its plant to enable the guidelines to be met."

"Smokeless flares are common around the world today and AUSI intends to utilise such a flare for the AUSI Iron Project."

"AUSI is utilising best practicable technology (as defined in the EP Act) in the design of its plant. Factors affecting the choice of technology include minimisation of potential environmental impacts, cost, energy consumption, and product quality. AUSI believes that the technology currently available is not able to reach a zero emission discharge. Even if the technology were available on today's market, it would not be economically viable in the current world market. The achievement of a zero emission goal is primarily limited by the available technology."

"The use of Direct Reduction (DR) and Electric Arc Furnace (EAF) technology represents a significant reduction in the emissions that occur when compared to conventional steel making processes. In addition to the decreased emissions, DR and EAF technology result in a significant reduction in the energy requirements of steel production."

"Table 3.1 of the CER lists the approximate composition, annual usage and production rates for raw materials and the product. This table shows that a total of 6.3 million tonnes per annum (Mtpa) of iron ore with a sulphur content of 0.01 - 0.02% will be used by the plant. Figure 3.4 indicates that approximately 4.66Mtpa of this ore will be fines, with the remaining 1.65Mtpa being coarse or lump ore. Figure 3.4 also indicates that the fine ore goes through a concentrator with approximately 1.31Mtpa going to the tailings dam. Oversized ore from the concentrator goes directly to the Direct Reduction shaft furnaces. Therefore, the pellet plant only receives approximately 3.3Mtpa of fines."

"The pellet plant produces spherical pellets of approximately 18mm in diameter which contain cellulose based organic binders and metallurgical additives. The "green" pellets are passed through an induration furnace which removes approximately 40% of the sulphur contained in the ore. The temperature of the induration furnace is such that the Direct Reduction shafts remove very little of the remaining sulphur from the pellets, however, some sulphur is released during the reduction of the lump ore. The HBI product (reduced pellets and reduced lump ore) contains the remaining sulphur. Table 3.1 of the CER shows that the HBI product can contain up to 0.1% sulphur."

"With regards to the issue of the maximum predicted ground level concentrations of sulphur dioxide occurring under normal operating conditions, Tables 3.3 and 3.4 of the CER presented the expected emission rates of sulphur dioxide for these scenarios. All of the upset conditions identified and presented within Table 3.4 resulted in a decrease in the overall sulphur dioxide emission rate from the plant primarily due to the shutdown of one or more components of the plant. Without these components operating, the total sulphur dioxide emission rate decreases and hence the predicted maximum ground level concentrations of sulphur dioxide decrease. Therefore, as stated in Section 7.6.5 of the CER, the maximum ground level concentrations of sulphur dioxide are predicted to occur under normal operating conditions when the maximum emission rate of sulphur dioxide is predicted to occur."

"The production of HBI is an energy intensive exercise which results in a significant emission of greenhouse gas emissions. There are two major options available for Proponents to minimise the impacts of their carbon dioxide emissions:

- energy efficiency resulting in reduced emissions on a global perspective for the production of a similar product in another location; and/or
- sink compensation usually involving the planting of trees."

"AUSI is aware of the potential problems related to carbon dioxide emissions and global warming and has made every effort to maximise the energy efficiency of the project. As stated in the CER, the proposed DR/HBI plant has been designed to maximise the effective usage of energy with the major energy efficient features being:

- the pellet plant recovers the burner off-gasses for use in the drying and preheating stages;
- the direct reduction shaft and HBI process recovers heat from the reformer flue gas and recycles it to the reformer by using it to preheat the reformer combustion air and the process gas which is reformed and sent to the shaft furnace; and
- gas based direct reduction processes are generally highly energy efficient as they produce metallic iron without using energy to melt the iron which occurs in the smelting process."

"The energy efficiency of the project will decrease the overall carbon dioxide emission rate per tonne of HBI to a very low figure. For example it is estimated that the Project, operating at a maximum production rate of 3.6Mtpa, would emit a total of 2.8Mtpa of carbon dioxide which is equivalent to 0.78t of carbon dioxide per tonne of HBI. This rate of carbon dioxide production includes the carbon dioxide produced by the power station. On the other hand, the recently approved BHP HBI plant PER stated that its HBI plant (excluding the power station) would emit approximately 1.7Mtpa of carbon dioxide for its production rate of 2Mtpa HBI. This equates to 0.85t of carbon dioxide per tonne of HBI and excludes the carbon dioxide emitted by the power station."

"Therefore, AUSI believes that it has a highly energy efficient project which will minimise the emissions of carbon dioxide as far as possible. Due to the commitment to high energy efficiency and reduced emissions on a global perspective for the production of a similar product in another location, AUSI do not wish to enter into sink compensation programmes."

Commitments made by the proponent

With respect to gaseous emissions and odours, the proponent has made the following environmental commitments (refer to Appendix 5 for full list of commitments):

1. Prior to commencement of construction, the Proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment.

6. The Proponent will use the best practicable technology during the operation of the Project to ensure that the emissions of oxides of nitrogen from the power station do not exceed $0.07 g/m^3$ (expressed as NO_2 at 0^oC, 101.3kPa, 15% oxygen, dry). This will be undertaken to the reasonable satisfaction of the Minister for the Environment.

7. The Proponent will minimise the emissions of hydrogen sulphide by:

- monitoring the dosage of di methyl disulphide to minimise the emissions of hydrogen sulphide from the reformer gas stream; and
- partially incinerate the direct reduction shaft emission of hydrogen sulphide prior to its discharge.

These activities will be undertaken during the operational phase to the reasonable satisfaction of the Minister for the Environment.

In the unlikely event that odours are detected in residential areas and the AUSI Iron Project is identified as the source, the proponent will take reasonable action to isolate the source of the odours within the plant and undertake reasonable remedial action to eliminate the problem.

10. The Proponent will conduct periodic monitoring of the major point source emissions for sulphur dioxide, oxides of nitrogen, particulates and hydrogen sulphide. The frequency of such testing will be determined in consultation with the EPA and the monitoring programme will be undertaken to the reasonable satisfaction of the Minister for the Environment.

11. The total carbon dioxide emission for the Project will be calculated by the Proponent on an annual basis and reported to the EPA. These activities will be carried out to the reasonable satisfaction of the Minister for the Environment.

4.4.5 Evaluation

Following advice from the DEP and DOME and the proponent's response to questions raised, the EPA considers that gaseous and odorous emissions from the proposed AUSI Iron Project DR/HBI Plant would be manageable and acceptable, given its remote location. The EPA notes and strongly endorses the commitments made by the proponent, particularly with respect to the control of H_2S emissions and its decision to use best practicable technology to ensure that the NO_x emissions from the power station do not exceed NH&MRC guidelines.

Notwithstanding the above, the EPA recommends that the proponent's Environmental Management Programme (EMP) should include the following information with respect to gaseous emissions (including greenhouse gases) and odours, to the satisfaction of the Environmental Protection Authority on advice from the DEP (Recommendation 2):

- a monitoring and audit programme for all gaseous and odorous emissions (stack and ambient), including greenhouse gases. Reports of the results of this monitoring programme should be submitted at appropriate intervals to the Department of Environmental Protection for audit and should be made publicly available;
- calculations of the greenhouse gas emissions associated with the proposal (using appropriate methodology developed for Australia);
- note the Governments desire to stabilise greenhouse gas emissions by the year 2000 and progressively reduce them thereafter. Also note the Revised Greenhouse Strategy for Western Australia 1994 and the United Nations Framework Convention on Climate Change (FCCC); and
- the proponent shall use their best endeavours to comply with the Government position and FCCC Convention on greenhouse gas emissions and report on their progress.

In relation to the DEP's concern pertaining to the lack of quality climatic data for the region, the Environmental Protection Authority considers that as a result of the increasing interest in industrial development in the Karratha to Cape Lambert area, surface air quality data should be collected and a meteorological measurement network established so as to ensure accurate air quality computer modelling predictions can be performed for future proposals. Accordingly, the EPA recommends that government should establish a suitable meteorological measurement network and climatic data collection programme to achieve this objective (Recommendation 4).

4.5 Dust and particulate emissions

4.5.1 Objective

The Environmental Protection Authority's objective is to protect surrounding residents and land uses so that dust and particulate emissions from the proposed AUSI Iron Project DR/HBI Plant will not impact upon their amenity or cause health problems. To meet this objective, the company would have to comply with the EPA's criteria for dust and particulates.

4.5.2 Evaluation framework

Existing policy framework

Western Australia does not have any state-wide regulatory ambient standards for dust and particulates. The DEP and EPA base environmental acceptability on the criteria established by other authorities such as the National Health and Medical Research Council (NH&MRC), Victorian EPA (VEPA), United States Environmental Protection Agency (USEPA) and World Health Organisation (WHO).

In the case of particulates, the EPA generally uses as criteria the ambient standards that are part of the Environmental Protection Policy (EPP) for Kwinana which was promulgated by the State Government on 17 July 1992. Under this EPP, the EPA has set ambient standards and limits

for particulates for three air quality policy areas at Kwinana which are detailed in Table 11 below:

TABLE 11
KWINANA EPP AMBIENT STANDARDS AND LIMITS FOR PARTICULATES

	Standard ($\mu g/m^3$)	Limit ($\mu g/m^3$)	
	24-Hour Average	15-Minute Average	24-Hour Average
Area A	150	1,000	260
Area B	90	1,000	260
Area C	90	1,000	150

The three air quality policy areas are defined as follows:

- Area A - used mostly for industrial purposes;
- Area B - a buffer zone between industry and residential use; and
- Area C - the area beyond the buffer zone.

Industry is required to aim at controlling its emissions to produce air quality better than the standard while the limit should never be exceeded.

Technical information

Particulates/Dust

Particulates emitted by the proposed DR/HBI plant can be categorised into two major groups:

- fugitive dust emissions; and
- stack emissions.

Fugitive Dust

The main sources of fugitive dust emissions are detailed in Table 12 below, together with measures planned to suppress or contain any fugitive dust emissions.

TABLE 12
FUGITIVE EMISSIONS SOURCES AND MANAGEMENT

Dust Source	Management of Fugitive Emissions
RAW MATERIALS AREA	
Ore Car Dumper	Dust extraction system to bag filter or equivalent plus water sprays if necessary.
Ore Stacker	Water sprays
Ore Stockpiles	Water sprays
Ore Reclaimer	Water sprays
Miscellaneous Conveyors	Minimise number of transfer points. Conveyor transfer points enclosed.
CONCENTRATOR	
Minimal dust generation during wet beneficiation.	
Tailings handling and disposal	Tailings in slurry form or wet filter cake to prevent dust generation during handling.
PELLET PLANT	
Concentrate and flux handling	Minimise number of transfer points. Conveyor transfer points enclosed. Bag filters on storage hoppers.
Hood and windbox exhaust	Scrubbers or electrostatic precipitators to reduce particulate emissions to less than $100mg/m^3$.
Pellet handling	Minimal dust generation as pellets are hard.
HBI PLANT	
Process offgas	Wet scrubber to remove particulates from offgas. Reformer flue gas dust content less than $100mg/m^3$.
Briquette screening	Dust extraction system to bag filter or equivalent plus water sprays if necessary.
Briquette stockpiles	Water sprays during handling.
Briquette handling	Minimise number of transfer points. Conveyor transfer points enclosed.

Source: Table 3.5 of the CER.

Stack Emissions

The estimated emission rates of particulates and the associated emission characteristics for each source associated with the DR/HBI plant were presented in Section 3.7 of the CER.

The CER stated that Version 2 of the US EPA's Industrial Source Complex Short Term (ISCST2) regulatory air dispersion model was used to predict maximum 24-hour ground level concentrations of particulates and the results are detailed in Table 13 below.

TABLE 13

MAXIMUM PREDICTED 24-HOUR PARTICULATE CONCENTRATIONS STACK SOURCES

Location	Maximum Predicted 24-hour Average Concentration ($\mu g/m^3$)
Model Grid	30.4
Wickham	6.2
Surrounding hill-tops	40.1

Note: For the purposes of the modelling the particulate size distribution was assumed to be 90% <1μm and 10% between 1 and 10μm.

The CER stated that air dispersion modelling of particulate sources indicated that the WA Environmental Protection Policy (Atmospheric Wastes) (Kwinana) limits would not be exceeded.

The CER indicated that all process gas streams containing particulates would be scrubbed prior to discharge so that the particulate concentration will not exceed 100mg/m^3.

Fugitive Emissions - Construction

Localised dust will be generated during the construction phase from earthworks, movement of vehicles and from exposed ground surfaces. The degree of dust generated would depend on the moisture content of the ground surface during construction. In general, the sandy soils of the site would give rise to low fugitive dust levels.

The CER stated that the impact of dust during construction is expected to be minor and localised and that Wickham residences are unlikely to suffer any dust nuisance.

The CER also indicated that dust levels would be visually monitored on the site during construction by the construction contractor and that dust suppression would be instituted, using water trucks, sprinklers and other means as necessary, in the event that:

- high levels of dust are observed;
- strong winds and dry conditions make dust generation likely; and
- complaints about dust are received.

The site access road used during construction will be sealed to minimise dust generation from traffic movements.

Fugitive Emissions - Operations

Katestone Scientific (1995) conducted an analysis of the proposed plant and assessed the potential for fugitive dust generation and its findings are summarised below.

Fugitive dust may be generated by following processes:

- site activity and any disturbance of the stockpiles;
- load in and load out activities;
- wind action on the stockpiles; and
- any emissions from the processing area.

The CER indicated that the potential for fugitive dust generation through the processing area is minimised as the process is either "wet" or uses very hard substances (eg. pellets and lump ore) that are not likely to produce any significant quantities of dust.

The proposed design of the DR/HBI plant incorporates many features to reduce dust generation which include the:

- orientation of the stockpiles;
- use of dust extraction and water sprays on the dumper;
- enclosure of the conveyor transfer points; and
- use of water sprays on stockpile operations.

Another key aspect in minimising the dust impact is the full education and ongoing enthusiasm of the plant staff to appreciate the impact of non-routine events (e.g. spillages, adverse weather). These aspects will be incorporated into the environmental management programme.

The major potential source of fugitive dust emissions are the stockpiles of iron ore fines. Several general types of control measures are available to minimise fugitive dust generation and these include:

- controlling the nature of the surface of the stockpile;
- reducing the re-suspension of fine material that can occur during loading operations, conveyance and the use of vehicles within the stockpile area;
- reducing the impact of wind on the stockpile areas; and
- intercepting and controlling any dust in areas downwind of the stockpiles.

The typical moisture content of 5.2% in the project iron ore is sufficiently high to ensure that a watering programme will be effective in ensuring that the surface moisture of the stockpile does not fall below 5%. Wind tunnel tests have shown that surfaces with a moisture content of 4-5% are not easily eroded (Katestone Scientific, 1995).

To ensure that dust generation from the project is minimised the CER stated that the Proponent would implement the following measures:

- high standard of house-keeping involving:
  - the regular cleaning of areas likely to accumulate fine particulate;
  - sealing of major roadways;
- maintaining a "green" belt around the facility to act as a local buffer;
- covering of conveyor transfer points to ensure that fine particulates are trapped within the transfer tower;
- placement of the stockpile axis along the direction of the predominant winds;
- use of water sprays to minimise potential dust lift-off from the raw material stockpiles;
- use of water sprays on roads (if required);
- use of particulate scrubbing equipment (i.e. waste gas cleaning and de-dusting); and
- where practical the coarse tailings may be added to the top of the fine tailings to minimise dust generation.

Comments from key government agency

The Department of Environmental Protection (DEP) carried out a technical evaluation of the information presented in the CER relating to the dust and particulate emissions and detailed the following concerns:

The DEP expressed concern as to why Commitment 12 (relating to ambient dust monitoring), and as originally defined in the CER, had been made conditional in the event of complaints occurring. The DEP was also concerned about why the proponent did not consider it necessary to perform baseline monitoring of dust and particulate emissions. The DEP indicated that the

proponent should undertake both baseline and on going monitoring and that this data should be made available at regular intervals and prior to complaints occurring.

4.5.4 Public submissions

No public submissions were received with respect to the issue of dust and particulate emissions emanating from the proposed DR/HBI plant.

4.5.4 Proponent's response

In response to the issues detailed in the government agency and public submissions, the proponent provided the following comments:

"Sections 3.7.3 and 7.6.8 outlined the methodologies that would be used by AUSI to minimise its dust emissions. Commitment 9 states that the Proponent will minimise dust emissions during operation of the facility by the following measures:

- maintain a landscaped perimeter around the facility;
- use of particulate scrubbing equipment;
- covering of conveyor transfer points;
- regular cleaning of areas likely to accumulate dust;
- sealing of major roadways; and
- use of water sprays on stockpiles.

"AUSI believes that it is more appropriate to focus its attention on the minimisation of dust emissions from the Project rather than undertake a regular monitoring programme. AUSI expect that impact of any fugitive dust emissions will be small due to the plant design and the proposed control measures and as such an ongoing monitoring programme is not warranted. However, AUSI is prepared to modify Commitment 12 to undertake periodic dust monitoring in the vicinity of the plant as follows."

"The Proponent will monitor ambient dust levels in the vicinity of its plant on a quarterly basis. A dust deposition monitoring programme would be established to record the dust deposition on a quarterly basis. In addition, ambient dust concentrations will be monitored in the event that dust complaints relating to the Project occur. The monitoring programme will be conducted to the satisfaction of the Minister for the Environment."

Commitments made by the proponent

With respect to dust and particulate emissions, the proponent has made the following environmental commitments (refer to Appendix 5 for full list of commitments):

1. Prior to commencement of construction, the Proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment.
8. The Proponent will implement dust mitigation measures including containment and suppression during the construction of the Project to the reasonable satisfaction of the Minister for the Environment.
9. The Proponent will minimise dust generation during the operation of the facility by implementing the following measures to the reasonable satisfaction of the Minister for the Environment:
    - maintain a landscaped perimeter around the facility;
    - use of particulate scrubbing equipment;
    - covering of conveyor transfer points;
    - regular cleaning of areas likely to accumulate dust;

- sealing of major roadways; and
- use of water sprays on stockpiles.

12. The Proponent will monitor ambient dust levels in the vicinity of its plant on a quarterly basis. A dust deposition monitoring programme would be established to record the dust deposition on a quarterly basis. In addition, ambient dust concentrations will be monitored in the event that dust complaints relating to the Project occur. The monitoring programme will be conducted to the reasonable satisfaction of the Minister for the Environment.

4.5.5 Evaluation

Following advice from the Department of Environmental Protection, and the proponent's response to questions raised, the EPA considers that this issue is manageable given the remote location of the proposed plant. The EPA notes the commitments made by the proponent to implement dust mitigation measures and to undertake programmes to monitor ambient dust levels and to record dust deposition in the vicinity of the plant on a quarterly basis, or whenever complaints relating to the project occur.

Notwithstanding the above, the EPA recommends that the proponent's Environmental Management Programme (EMP) should include a monitoring and audit programme for all dust and particulate emissions from the plant (including fugitive dust) and the moisture content of storage stockpiles as a means of gauging the effectiveness of dust control. Furthermore, reports of the results of these monitoring programmes should be submitted at appropriate intervals to the Department of Environmental Protection for audit, and that they should be made publicly available (Recommendation 2).

4.6 Liquid and solid waste disposal

4.6.1 Objective

The Environmental Protection Authority's objective is to protect both surface and groundwater resources, terrestrial and marine flora and fauna and the health and amenity of surrounding residents from potential impacts from liquid and solid waste disposal operations associated with the proposed DR/HBI plant.

4.6.2 Evaluation framework

Existing policy framework

Liquid and solid wastes are to be managed in accordance with the requirements of local government authorities and relevant government departments. Sewerage systems are to be approved by local government authorities, The Water Authority of Western Australia (WAWA) and the Health Department of WA.

Technical information

Concentrator tailings

The major solid/liquid discharge from the plant will be tailings from the concentrator. The tailings consist of low grade iron ore similar to that found all over the Pilbara. The concentration of ore is performed in fresh water with no chemical additives, so the tailings will not contain any residual process chemicals.

Three streams of tailings will be generated:

- two coarse tailings streams (0.1-1mm and 1-6.3mm) generated from the gravity separation concentration processes. These streams will be transported by conveyor and spreader system to the coarse tailings disposal area as filter cake; and
- one fine tailings stream (<0.1mm) generated from the magnetic separation process for final ore concentration. This stream will be thickened to the minimum water content possible before being pumped in slurry form to the fine tailings disposal area.

Tailings will be disposed of and stored in two ways, depending on whether they are coarse (filter cake) or fine (slurry). Fine tailings will be pumped to a tailings dam for impoundment and water recovery. Construction of this dam will initially be carried out using local borrow material (possibly from the body of the dam itself) to build an embankment to RL28.00. This will provide sufficient storage for 2 years of operation during which time the embankment will be progressively raised to its final level at RL40.00 (after 20 years of operations) using coarse tailings material (subject to suitable geotechnical characteristics). Detailed geotechnical investigations will be undertaken prior to the construction of the tailings dams and the dams will be designed to comply with the requirements of the DOME.

Coarse tailings will be removed by conveyor and spread into a landfill disposal area to the north west of the plant site. Landfilling operations will proceed by building up the ground in a series of benches of between 10-15m in height with face slopes of 1 vertical to 2 horizontal or as required for stability following the geotechnical assessment of the material. Coarse tailings for the embankment construction will be taken from the landfill area as required.

The coarse tailings storage area will be located relatively close to the coast and its base will be below the 1 in 100 year storm surge level. Therefore, the storage area will have to be designed to protect the tailings from being eroded during these events.

A starter dyke will be required to allow placement of the coarse tailings without erosion of the tailings by high sea levels and wave action. The outside slope of the dyke will, however, also need to be protected from erosion. Three preliminary designs for the dyke and the associated slope protection works were presented in Figure 3.3 of the CER as a function of the water depth and maximum wave height on the outside of the starter dyke which in turn, are partly controlled by the ground level. The final design will depend on the results of more detailed studies.

The CER indicated that the dyke would be constructed from soils excavated from within the tailings area. This would minimise disturbance of areas outside the pond area and minimise the cost of construction of the dyke. The rock armour and filter materials required for slope protection would need to be obtained from outside the pond area. Geotechnical and engineering studies would be undertaken to determine technically and economically viable sources of these materials. The filter material may, however, be a synthetic fabric.

Other Wastes

Construction activities will generate a number of different types of waste, including:

- inert waste including excess fill and building rubble;
- organic debris including vegetation;
- general refuse including scrap metal, cardboard and plastics;
- toxic or hazardous wastes such as waste oils and solvents;
- sewage and sullage; and
- hydrostatic test water used for testing of pipelines.

Apart from tailings, the operation of the plant will generate a number of different wastes, the most significant of these being the sea water cooling circuit discharge. The management of the sea water cooling circuit discharge is discussed in Section 4.1.2 of this report. Other wastes that will be generated include general refuse, waste oils and solvents, and sewage.

Solid and liquid waste disposal

The CER stated that different types of wastes will be kept and disposed of separately as far as is practicable. Inert wastes such as building rubble will be used as fill. If there is an excess of fill, inert waste will be used as fill elsewhere or disposed of in a council-approved landfill site.

Plant debris and other non-putrescible organic material will, if present in sufficient quantity, be mulched and retained for later use in landscaping. Alternatively, it will be disposed of in an approved landfill. General refuse will be disposed of in an approved landfill.

Waste oils and solvents will be collected in drums or tanks and will be periodically removed by a licensed contractor for recycling or disposal at an approved liquid waste disposal site.

Portable toilets and washing facilities will be provided on site during construction. These facilities will retain sewage and sullage in sealed tanks until they are removed by a licensed contractor for disposal into a Water Authority sewage treatment facility or an approved liquid waste disposal site. Sewage and sullage from the plant will be treated with a package waste treatment plant.

Hydrostatic testing of the pipelines will generally be undertaken using fresh water that may be treated with an oxygen scavenger such as sodium metabisulphite to absorb dissolved oxygen and prevent internal corrosion. The small quantity of water required for hydrostatic testing of the pipeline would be collected and re-used if possible. In the event of a discharge, the treatment chemicals break down to benign compounds upon exposure to air.

The plant site will be drained such that rainwater flows into a small dam. Water in this dam may be re-used in the plant. The volume of the dam is designed to collect runoff generated in the first twenty minutes of a heavy rainfall event. 'First flush' runoff contains most of the dust or waste generated in the catchment area. Additional runoff will result in overflow from the dam wall and flow to lower ground.

Wash down areas for vehicles, mobile equipment and any other areas that are identified as potential sources of oil-contaminated run-off shall be designed to contain the run-off. Such areas will be designed as concrete bunded areas which flow to one or more collection sumps. Contaminated runoff shall be drained from the sumps via a valve controlled discharge. The valve will normally be closed. When accumulated runoff is drained from the bunded area it will pass a coalescing plate solids and oil separator to retain any oil or diesel contamination. The separated oil will be collected into 200 litre drums and the effluent directed to a standard absorption pit in compliance with the quality requirements of the relevant regulations.

Comments from key government agencies

The Department of Environmental Protection (DEP) carried out a technical evaluation of the information presented in the CER relating to the liquid and solid waste disposal and provided the following comments:

"It is critical that there are accurate long term scenarios for tailings disposal. Tailings disposal seems to be considered a minor environmental issue in many projects, yet they are one of the more insidious forms of long term risk to the environment, particularly as they will not be actively managed in the long term by the proponent after decommissioning."

"The CER makes predictions about the volume of fines produced over a twenty year period, yet there is no allowance for increasing production rates over that period. In addition, there is no prediction about the coarse tailings requirements over a twenty year, or any other period. The coarse tailings will presumably take up a larger volume than the fines."

The Water Authority of Western Australia (WAWA) provided the following comments:

"The Authority recognises that, although the proponent addresses the management and disposal of waste oils/solvents and other toxic materials, there are no commitments made by the proponent (refer 7.9.1)."

"The WAWA therefore recommends that the proponent includes a commitment that all waste oils and solvents will be collected in drums or tanks and will be periodically removed by a licensed contractor for recycling or disposal at an approved liquid waste disposal site. This should apply to both the construction and operational stages of the project."

"Although the proponent has indicated that it would be using fresh water that may be treated with an oxygen scavenger such as sodium metabisulphite to prevent internal corrosion of plant pipework, in the event of this water not being reused, no mention was made of where this waste water would be discharged if it had to be."

The Department of Minerals and Energy Western Australia (DOME) provided the following comments:

"The revised CER addresses most of the queries made following the Department's review of the draft CER, however there are still some outstanding issues, viz:

- tailings storage details (it is assumed this will be covered at a later date in another document or in the EMP); and
- AUSI should be requested to maintain an inventory of the volume, contents and location of all waste disposal sites (these should be indicated on the site plan for future reference)."

4.6.3 Public submissions

No public submissions detailing concerns pertaining to liquid and solid waste were received.

4.6.4 Proponent's response

In response to the issues detailed in the public and government agency submissions, the proponent provided the following comments:

"AUSI believes that the fine tailings dam will be sufficient to meet the long term requirements for tailings disposal. Following decommissioning, the fine tailings dam will be rehabilitated as presented in Section 7.18.4 of the CER. The fine tailings are benign and will contain low grade ore similar to that found all over the Pilbara. The concentration of ore is performed in fresh water with no chemical additives, so the tailings will not contain any residual process chemicals (see Section 3.9.1.1 of the CER). Therefore, it is envisaged that the management of the tailings following decommissioning will not be a major issue following rehabilitation."

"AUSI no longer has a requirement for the coarse tailings storage facility. The predictions of tailings quantities presented in the CER are based on the typical ore composition expected to be supplied for a total production rate of 3.6Mtpa of HBI. Factors that can affect the quantity of tailings include:

- the quality of the ore; and
- the production rate of HBI."

"The planned capacity of 3.6Mtpa represents the maximum capacity expected from the three Direct Shaft Furnaces that will be used in the process after optimisation. Therefore, to significantly increase the capacity of the plant, additional Direct Reduction Furnaces would be required. Such an expansion (eg. 3.6 to 4.8Mtpa) will require an additional environmental assessment which would include the treatment of increased tailings."

"Sections 3.9.2 and 7.9.1 of the CER describe the methods proposed for the disposal of waste oils and solvents. AUSI has a legal responsibility to dispose of these wastes in an approved manner and so a specific commitment is not required."

"As stated in Section 7.9.1 of the CER, an oxygen scavenger may be added to water used for the hydrostatic testing of pipelines prior to the commencement of the operations phase. The quantity of water used for this purpose is expected to be small and would be collected and re-used where practical. In the event of a discharge, the treatment chemicals break down to benign compounds upon exposure to air. Therefore, it is not expected that this water will result in any unacceptable impacts, nor will it require any special management procedures."

"During the operation of the Project, only one main disposal site, being the fine tailings dam, will be utilised. AUSI will maintain an inventory of the quantity of fine materials deposited within the dam."

14. Prior to the construction of the tailings dams, the Proponent will undertake geotechnical investigations and will design and operate the dams to meet the reasonable requirements of DOME and the Minister for the Environment.

4.6.5 Evaluation

Following advice from the Department of Environmental Protection, WAWA and DOME, and the proponent's response to questions raised, the EPA considers that this issue is manageable. The EPA notes the commitments made by the proponent to prepare an EMP in consultation with the EPA and CALM and to undertake geotechnical investigations and design and operate its tailings dam to meet the reasonable requirements of DOME and the Minister for the Environment.

Notwithstanding the above, the EPA recommends that the proponent's Environmental Management Programme (EMP) should include a requirement for the proponent to maintain an inventory of the volume, contents and location of all waste disposal sites and that these details should be indicated on the site plan for future reference (Recommendation 2). Furthermore, the EMP should detail waste disposal approvals obtained by the proponent from relevant government authorities.

4.7 Noise

4.7.1 Objective

The Environmental Protection Authority's objective is to ensure that the health and amenity of surrounding residents is not impacted upon by noise emissions emanating from the DR/HBI Plant. To meet this objective, the EPA's criteria on noise as outlined below would have to be complied with.

4.7.2 Evaluation framework

Existing policy framework

The proposed AUSI Iron Project DR/HBI Plant would need to comply with the following criteria:

- the Noise Abatement (Neighbourhood Annoyance) Regulations (1979); and
- the proposed Environmental Protection (Noise) Regulations (when promulgated).

Technical information

Existing Noise Environment

A noise monitoring programme was conducted in the Wickham-Roebourne region over two nights to obtain an indication of the existing noise levels in the areas surrounding the project area and the results of this programme are presented in Dames & Moore (1995).

The results of the noise monitoring programme show that the existing noise levels in the residential areas of Wickham, Roebourne and the Aboriginal community at Cheeditha are quite high. The Aboriginal community at Cheeditha recorded the lowest L_{90} noise levels which were around 31dB(A). The lowest L_{90} noise level recorded in Wickham was 32.5dB(A). However, the L_{90} noise levels in Wickham were typically between 35-38dB(A) at two of the three monitoring sites. The major noise sources in these areas were domestic air conditioners, traffic noise, rail noise and dogs. Australian Standard AS1055-1974 indicates that noise levels more than 5dB(A) above the background levels can lead to complaints. Therefore, on the basis of the

monitoring programme, the project noise levels could reach 37.5dB(A) in the quietest areas before any complaints are likely to occur.

Construction Noise

Localised noise will be generated during construction by earthmoving machinery, rollers, trucks and other mechanical equipment in use on the site. These impacts are expected to be localised and not create a nuisance beyond the boundary of the project area.

Noise and vibration impacts will be managed by the following means:

- noise generation from stationary and mobile equipment will not exceed 85dB(A) at 1m. Equipment used by contractors and subcontractors will be required to comply with this standard;
- if any complaints regarding noise are received, monitoring of noise levels and working activities will be undertaken; and
- the construction activities will comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979.

Predicted Noise Impact of the DR/HBI Project

A noise modelling study was undertaken to predict the noise levels likely to result from the project's operations during normal and upset conditions.

Noise Model Description

The noise model that has been used in this study is known as the Environmental Noise Model (ENM). The ENM package can perform most of the calculations normally required for assessing environmental noise impact.

The ENM package calculates the sound attenuation from single or multiple point sources, as well as line and area sources. The package accounts for:

- geometric spreading;
- directivity;
- barriers;
- air absorption;
- wind and temperature (meteorological) effects; and
- ground attenuation.

The package can also account for different source, receptor and terrain heights.

Modelling Methodology

The ENM package was used to model the noise levels resulting from the project for the following operational scenarios:

- normal operations; and
- upset conditions with the flare being used.

The meteorological conditions assumed for modelling purposes were as follows:

- following wind of 2m/s;
- relative humidity of 90%;
- air temperature of 10°C; and
- an inversion strength of 2°C/100m.

These conditions are thought to represent the worst case meteorological conditions that would result in maximised sound propagation. The modelling has assumed that the winds were blowing towards Wickham.

Digital terrain height information were obtained from the Department of Land Administration (DOLA) and has been used in the model.

Modelling Results

Section 3.8 of the CER presented the sound pressure levels expected to be associated with the major noise sources. Many of the noise sources are associated with fans and typical octave frequency spectra data for these sources were provided by the equipment suppliers. In cases where the frequency spectrum data for noise sources could not be obtained, the modelling was completed by using a flat frequency spectrum.

Normal Operating Scenario

Figure 7.3 of the CER presented the predicted noise levels resulting from the project during normal operations. It can be seen that the level of impact of the Project is predicted to be low under these operations. The 35dB(A) contour is localised and falls well short of Wickham (the closest residential area).

Worst Case Scenario

The worst case noise emissions scenario have been identified to occur when the flare is being used. ENM was used to predict the noise levels associated with the operation of the flare and the predicted noise levels were presented in Figure 7.4 of the CER. This figure shows that the 35dB(A) contour extends over a much greater area than the normal operations scenario. Even under the worst case scenario, the noise levels in Wickham are predicted to be less than 30dB(A) which well below the recommended criteria of 40dB(A).

The CER indicated that the proposed DR/HBI project is not predicted to result in unacceptable noise levels in Wickham during normal or upset conditions. In the event that noise levels attributable to the project exceed the EPA criteria, the proponent would take measures to achieve the required standards.

Other Noise Sources

The DR/HBI project will have a number of other noise sources associated with its operation including noise associated with:

- increased traffic movements;
- increased rail movements;
- the overland conveyor;
- the port facilities; and
- the sea water cooling water supply pump.

Each of these sources are briefly discussed in the following sections.

Traffic Noise

Main Roads Western Australia recommend that the acceptable noise level for traffic noise is an $L_{10\ (18hour)}$ of 63dB(A). This guideline is normally used by the EPA to assess traffic noise.

The construction workforce is expected to peak at approximately 1,600 people. The CER stated that the majority of this workforce will be housed in a construction camp and that the proponent would ensure that, where possible, the route chosen to convey the workforce between the camp and the Project site will minimise the traffic volume through the residential areas.

The United Kingdom Department of Transport (1988) traffic noise prediction model was used to predict the $L_{10\ (18hour)}$ noise levels. The modelling has been undertaken using the extremely conservative assumption that the majority of the construction workforce drives a vehicle to/from the site along the same road in addition to existing traffic. The modelling has been undertaken assuming a total of 3,000 vehicle movements. A further 10% increase (ie. 300) heavy vehicle movements have been added to this number. The average speed assumed was 60km/hr. The predicted $L_{10\ (18hour)}$ noise level at a distance of 20m from the road under this scenario is 58dB(A). This level is well below the recommended acceptable noise level for traffic noise.

The size of the operational workforce will be much less than the construction workforce. Therefore, the traffic noise impact associated with the Project operations will also be acceptable.

The CER stated that the number of vehicle movements associated with the construction and operational workforce for the project is not sufficiently large to result in any exceedances of the $L_{10\,(18hour)}$ noise level of 63dB(A). However, where possible the proponent would minimise the volume of traffic associated with its project that passes through residential areas.

Rail Noise

The Project will receive one train load of iron ore per day. This train will be the same type as the trains that currently use the railway line and the addition of one train per day is not expected to significantly impact on the noise levels associated with existing rail activities.

Overland Conveyor

The HBI product will be transported from the plant site to the port via an overland conveyor. This will be an elevated (approximately 1m above ground level) belt conveyor and will have the minimum number of transfer points. The noise impact from this type of conveyor is expected to be small with the most significant noise source being associated with the transfer points. The CER indicated that the proponent would enclose the transfer points to minimise the noise impacts. However, the CER did not indicate whether the proponent would utilise low noise rollers on the conveyor. In addition, the CER stated that it is not proposed to route the conveyor in close proximity to residential areas.

The CER indicated that the proponent would undertake surveys along the conveyor's length to ensure that its noise emissions are minimised.

Port Facilities

The HBI product would be exported by ship with an average of three ship movements per week. This number of ship movements is not expected to result in any unacceptable noise impacts.

Sea Water Cooling Water Supply Pump

The pump used to supply the sea water for the cooling circuits of the project will be located in a pump house and is therefore not expected to result in any unacceptable impacts.

The CER indicated that the activities and infrastructure associated with the proposed DR/HBI project (traffic noise, rail noise, overland conveyor, port facilities and sea water pump) are expected to result in acceptable noise levels in Wickham.

Comments from key government agency

The Department of Environmental Protection (DEP) carried out a technical evaluation of the information presented in the CER relating to noise emissions, and considered that this issue was manageable in view of Commitment 13 made by the proponent in relation to compliance with noise regulations (refer to Appendix 5), and the remote location of the proposed plant.

4.7.3 Public Submissions

One submission expressed concern that Table 1 of the CER indicated that the proponent intended to monitor the noise levels of the conveyor on a regular basis, but made no attempt to predict the noise levels of the operating conveyor and its impact on Wickham residents. The submission stated that since the conveyor would be operating 24 hours/day over some 200 days/year, it would be too late to determine noise problems after the conveyor was built and operating. The submission also stated that further studies were needed to determine potential noise levels.

4.7.4 Proponent's response

In response to the issues detailed in the public submissions, the proponent provided the following comments:

"Section 7.7.5.3 states that it is expected that the noise impact from the belt conveyor will be small with the most significant impacts associated with the transfer points. The Proponent will enclose the transfer points to minimise the noise impacts from these sources. As stated in Section 7.7.5.3 the Proponent will also undertake surveys along the conveyor's length to ensure that its noise emissions are minimised. The proponent has made a commitment (Commitment 13) to undertake remedial measures in the event that noise levels attributable to the project (including the conveyer) exceed the EPA criteria."

"The noise impacts of the conveyor were not modelled within the CER as the exact location of the conveyor route will not be known until agreement on the port design has been reached. The Proponent's preferred position, as stated within the CER, is that the existing Cape Lambert facilities be used for the project and the negotiations with Robe River are still continuing in regards to this. The Proponent has made the commitment (Commitment 15) to complete an assessment of the potential impacts of the port site and its associated infrastructure (including the conveyor) once these issues have been resolved."

Commitments made by the proponent

With respect to noise emissions, the proponent has made the following environmental commitment:

1. The Proponent will ensure that noise associated with the construction and operation of the Project will comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979. If noise levels attributable to the Project exceed EPA criteria, the Proponent will take measures to minimise the impact and achieve the required standards. These measures will be carried out to the reasonable satisfaction of the Minister for the Environment.

4.7.5 Evaluation

Following advice from the Department of Environmental Protection, and the proponent's response to questions raised, the EPA considers that this issue is manageable given the remote location of the proposed plant. The EPA notes the commitment made by the proponent to ensure that noise associated with the construction and operation of the Project will comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979. Notwithstanding the above, the Environmental Protection Authority recommends that the proponent's Environmental Management Plan (EMP) should include a noise assessment of the overland conveyor prior to commissioning.

5. Conclusions & Recommendations

5.1 Summary of issues

Table 1 summarised the process used by the Environmental Protection Authority to evaluate the topics raised during the environmental impact assessment process. The table identifies the topics and the proposal characteristics in relation to the topic. The comments received from Government agencies and the public are then evaluated in the process of the identification of issues.

The remaining issues, as identified in Table 14 (below), warranting further evaluation by the Environmental Protection Authority are:

Table 14 . Summary of Environmental Protection Authority recommendations.

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENTS	EPA RECOMMENDS
Biophysical impacts				
Marine and near shore impacts associated with the intake and discharge of ocean water for cooling purposes and from clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), especially impacts on mangroves, corals, sea turtles, dugongs and other marine life. Need for the proponent to prepare oil/chemical spill contingency plan.	To protect the marine environment from potential impacts associated with the intake and discharge of ocean water for plant cooling purposes and possible port development proposed AUSI Iron Project DR/HBI plant.	Characteristics of ocean cooling water intake and discharge identified, as well as potential impacts on the marine environment. Monitoring requirements also identified.	The proponent made commitments to: • prepare an EMP; • assess impacts of port site and infrastructure; • assess the sensitivity of receiving environment to marine discharge prior to construction; • not to discharge water more than 4°C above ambient ocean temperature; • undertake survey of toxic contaminants in the effluent, including organic compounds and heavy metals in the marine sediment and biota; • assist in investigations, remedial action on plant and affected areas if contamination identified; • periodically monitor ocean water quality in vicinity of ocean intake and discharge streams.	Proponent's Environmental Management Programme (EMP) to detail the following: • the nature and location of the intake, and discharge points on the Robe River Mining Co Ltd jetty; • predict the ocean water quality, including water temperature change at and around the ocean outfall and compare it to an agreed water quality standard, including commitments (Appendix 5); • the sensitivity of the marine ecosystem to changes in temperature and the adequacy of a 4°C above ambient ocean water temperature discharge limit (Commitment 17 Appendix 5); • the method for determining the mixing zone; • baseline monitoring of environmental conditions at and around the ocean outfall; and • an oil/chemical spill contingency plan. • verification that mixing and the transport of cooling water at the ocean outfall meets the agreedstandard; • rectification measures in the event that monitoring indicates that water quality, including cooling water discharge mixing and transport at the ocean outfall are not to the agreed standard; and • details of mangroves lost during construction or operation of the project and proposed rehabilitation programme.

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENTS	EPA RECOMMENDS
Protection of terrestrial flora and fauna.	To protect flora and fauna (including migratory birds) in the Wickham to Cape Lambert region from harmful impacts (including weeds) associated with the development and operation of the proposed DR/HBI plant. To ensure that the conservation status of flora and fauna in the region is properly recognised and that an adequate fauna survey is carried out.	Evaluation of the adequacy of the flora and fauna surveys undertaken by the proponent and potential impacts on flora and fauna.	Prior to commencement of construction, the proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment. The proponent will progressively rehabilitate disturbed areas to minimise disturbance of biological communities. The rehabilitation will be undertaken using best industry practice and will be completed to the reasonable satisfaction of the Minister for the Environment. Prior to the commencement of construction, the proponent will develop and implement a weed control and vehicle hygiene programme in consultation with CALM, the APB and other relevant DMA's and to the reasonable satisfaction of the Minister for the Environment. This programme will be included in the EMP.	The Environmental Protection Authority recommends that the proponent should undertake a fauna field survey of the region with the view of appropriate rehabilitation as required, prior to the proposed plant being commissioned, in order to quantify the results of the desktop study detailed in the CER.

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENTS	EPA RECOMMENDS
The impacts on ground water and existing surface hydrology (stream location, flood plain alteration etc) due to the construction and operation of the plant and tailings dams.	To protect both ground water and surface water resources in order to prevent impacts to both the terrestrial and marine environment's, including nearby mangroves, resulting from activities associated with the proposed DR/HBI plant.	Characteristics of ground water regime and existing surface hydrology identified. Potential impacts from construction and operational activities and tailings dams also identified. Ground water and surface water monitoring requirements also identified.	Establish a programme to monitor total dissolved solids, total suspended solids, pH and conductivity in the principal tributary prior to its discharge from site. Proponent will limit off-site transport of sediments by use of sedimentation ponds, minimisation of exposed surfaces and identification and treatment of on-site areas with erosion potential. Prior to the construction of the tailings dams, proponent will undertake geotechnical investigations. Prior to commissioning, the proponent will establish a ground water monitoring programme to record the water quality and depth of the water table at the perimeter of the plant area and the fine tailings dam.	Proponent's Environmental Management Programme (EMP) to include the following: • the control of surface water, runoff, drainage and tailings dam such that the ground water is protected ; • a water efficiency and conservation programme relating to the usage of fresh water; • a monitoring and audit programme for ground water and surface water quality at and around the plant and tailings dam, with particular emphasis on iron as an indicator; and • a rehabilitation plan and closure strategy for the tailings dam;

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENTS	EPA RECOMMENDS
Gaseous emissions (including greenhouse gases and odours), and the lack of proper climatic data to facilitate effective computer air emissions modelling.	To ensure that gaseous emissions, including greenhouse gases and odours, both individually and cumulatively, do not cause environmental or human health problems.	Ambient gaseous emission levels at nearest residences to comply with the relevant standards of the Environmental Protection Policy (EPP) for Kwinana, provisional EPA policy on greenhouse gases and NHMRC and other appropriate guidelines.	Proponent will prepare an EMP. Proponent will use best practicable technology so that the emissions of oxides of nitrogen from power station do not exceed $0.07g/m^3$. Proponent will minimise the emissions of hydrogen sulphide by: • monitoring the dosage of dimethyl disulphide to minimise the emissions of hydrogen sulphide from reformer gas stream; and • partially incinerate the direct reduction shaft emission of hydrogen sulphide prior to its discharge. Proponent will take reasonable action to isolate the source of the odours within the plant and undertake remedial action to eliminate the problem. Proponent will periodically monitor all gaseous emissions from plant. Total carbon dioxide emission will be calculated .	Proponent's EMP to include the following: • a monitoring and audit programme for all gaseous and odorous emissions (stack and ambient), including greenhouse gases; • calculations of the greenhouse gas emissions; • note the Governments desire to stabilise greenhouse gas emissions by the year 2000 and progressively reduce them thereafter. Also note the Revised Greenhouse Strategy for Western Australia 1994 and the United Nations Framework Convention on Climate Change (FCCC); and • the proponent shall use their best endeavours to comply with the Government position and FCCC Convention on greenhouse gas emissions and report on their progress.

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENTS	EPA RECOMMENDS
Dust and particulate emissions.	To protect surrounding residents so that dust and particulate emissions from the proposed AUSI Iron Project DR/HBI Plant will not impact upon their amenity or cause health problems.	Ambient dust levels at nearest residences to comply with the requirements of the ambient standards that are part of the Environmental Protection Policy (EPP) for Kwinana which was promulgated by the State Government on 17 July 1992.	Proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM. Proponent will implement dust mitigation measures including containment and suppression during the construction of the project. Proponent will minimise dust generation during the operation of the facility by implementing the following measures. Proponent will maintain a landscaped perimeter around the facility. Proponent will use particulate scrubbing equipment. Proponent will cover conveyor transfer points and regular cleaning of areas likely to accumulate dust. Proponent will seal major roadways and use water sprays on stockpiles. Proponent will monitor ambient dust levels in the vicinity of its plant on a quarterly basis. A dust deposition monitoring programme will be established.	The Environmental Protection Authority recommends that the proponent's Environmental Management Programme (EMP) include the following: • a monitoring and audit programme for all dust and particulate emissions (including fugitive dust) and the moisture content of storage stockpiles as a means of gauging the effectiveness of dust control.

ISSUES	OBJECTIVE	EVALUATION FRAMEWORK	PROPONENT'S COMMITMENTS	EPA RECOMMENDS
Liquid and solid waste disposal.	To protect both surface and ground water resources, terrestrial and marine flora and fauna and the health and amenity of surrounding residents from potential impacts from liquid and solid waste disposal operations associated with the proposed DR/HBI plant.	Liquid and solid wastes are to be managed in accordance with the requirements of local government authorities and relevant government departments. Sewerage systems are to be approved by local government authorities, The Water Authority of Western Australia (WAWA) and the Health Department of WA.	Prior to commencement of construction, the proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment. Prior to the construction of the tailings dams, the proponent will undertake geotechnical investigations and will design and operate the dams to meet the reasonable requirements of DOME and the Minister for the Environment.	The Environmental Protection Authority recommends that the proponent's Environmental Management Programme (EMP) include the following: • an inventory of the volume, contents and location of all waste disposal sites. These details should be indicated on the site plan for future reference; and • details of waste disposal approvals obtained from relevant government authorities.
Noise.	To ensure that the health and amenity of surrounding residents is not impacted upon by noise emissions emanating from the DR/HBI Plant.	Daily noise levels at nearest residences to comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979 and the proposed Environmental Protection (Noise) Regulations.	The proponent will ensure that noise associated with the construction and operation of the project will comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979. If noise levels attributable to the project exceed EPA criteria, the proponent will take measures to minimise the impact and achieve the required standards. These measures will be carried out to the reasonable satisfaction of the Minister for the Environment.	The EPA considers that this issue is manageable in view of the commitment made by the proponent and the remote location of the plant. However, the EPA recommends that the proponent's EMP include a requirement for a noise assessment of the overland conveyor to be done prior to commissioning.

- marine and near shore impacts associated with the intake and discharge of ocean water for cooling purposes and from clearing, construction, dredging, filling, and operation of facilities and infrastructure (including possible new port facilities), especially impacts on mangroves, corals, sea turtles, dugongs and other marine life;
- protection of flora and fauna;
- potential impacts on groundwater and existing surface hydrology (stream location, flood plain alteration etc) due to the construction and operation of the plant and tailings dams;
- gaseous emissions (including greenhouse gases and odours), and the lack of proper climatic data to facilitate effective computer air emissions modelling;
- dust and particulate emissions;
- liquid and solid waste disposal; and
- noise.

5.2 Specific recommendations

The Environmental Protection Authority concludes that this proposal is environmentally acceptable, provided that the proponent's commitments, the recommendations of this report and the Environmental Conditions detailed in Section 6 are implemented. This conclusion is based on the understanding that if new port facilities and a new gas pipeline are required by the proponent, then they would be subject to separate formal assessement by the EPA.

The Environmental Protection Authority is satisfied that, using information currently available, the following recommendations may be made to the Minister for the Environment.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Australian United Steel Industry Pty Limited (AUSI) to construct and operate a Direct Reduction/Hot Briquetted Iron (DR/HBI) plant near Cape Lambert in the Pilbara region of Western Australia, is environmentally acceptable subject to the satisfactory completion of an EMP, successful implementation of the proponent's commitments and adoption of the EPA's recommendations.

In reaching this conclusion, the Environmental Protection Authority identified the main environmental factors requiring consideration to be:

- potential marine impacts associated with the intake and discharge of ocean water for cooling purposes (which may become contaminated with bleed-off water and anti-foulants). These may include potential impacts on mangroves;
- the impacts on ground water and existing surface hydrology (stream location, flood plain alteration etc) due to the construction of the plant and tailings dams.
- gaseous emissions (including greenhouse gases and odours);
- dust and particulate emissions;
- liquid and solid waste; and
- terrestrial flora and fauna.

The Environmental Protection Authority believes that these issues can be potentially managed by the commitments made by the proponent (refer to Appendix 5) and the recommendations made by the EPA. Accordingly, the Environmental Protection Authority recommends that the proposal could proceed as described in the Consultative Environmental Review, subject to the proponent's commitments to environmental management and the following recommendations of the Environmental Protection Authority.

Recommendation 2

The Environmental Protection Authority recommends that the proponent prepare a two stage Environmental Management Programme (EMP), which includes the following information, to the satisfaction of the Environmental Protection Authority on advice from the DEP:

Stage 1 - before commissioning, the EMP shall address, but is not limited to the following:

1. Ocean cooling water intake and discharge

- the nature and location of the intake, and discharge points on the Robe River Mining Co Ltd jetty;
- predict the ocean water quality, including water temperature change at and around the ocean outfall and compare it to an agreed water quality standard, including commitments (Appendix 5);
- the sensitivity of the marine ecosystem to changes in temperature and the adequacy of a 4°C above ambient ocean water temperature discharge limit (Commitment 17 Appendix 5);
- the method for determining the nature of the mixing zone;
- baseline monitoring of environmental conditions at and around the ocean outfall;
- an oil/chemical spill contingency plan.

2. Ground water and existing surface water hydrology

- the control of surface water, runoff, drainage and tailings dam such that the ground water is protected;
- a water efficiency and conservation programme relating to the usage of fresh water; and
- a monitoring and audit programme for ground water and surface water quality at and around the plant and tailings dam, with particular emphasis on iron as an indicator.

3. Gaseous emissions (including greenhouse gases and odours)

- a monitoring and audit programme for all gaseous and odorous emissions (stack and ambient), including greenhouse gases;
- calculations of the greenhouse gas emissions associated with the proposal (using appropriate methodology developed for Australia);
- note the Governments desire to stabilise greenhouse gas emissions by the year 2000 and progressively reduce them thereafter. Also note the Revised Greenhouse Strategy for Western Australia 1994 and the United Nations Framework Convention on Climate Change (FCCC); and
- the proponent shall use their best endeavours to comply with the Government position and FCCC Convention on greenhouse gas emissions and report on their progress.

4. Dust and particulate emissions

- a monitoring and audit programme for all dust and particulate emissions (including fugitive dust) and the moisture content of storage stockpiles as a means of gauging the effectiveness of dust control.

5. Liquid and solid waste disposal

- an inventory of the volume, contents and location of all waste disposal sites. These details should be indicated on the site plan for future reference; and
- details of waste disposal approvals obtained by the proponent from relevant government authorities.

6. Noise

- a noise assessment for the overland conveyor.

Stage 2 - After commissioning, the EMP shall address, but is not limited to the following:

1. Ocean cooling water intake and discharge

- verification that mixing and transport of cooling water at the ocean outfall meets the agreed standard;
- rectification measures in the event that monitoring indicates that water quality, including cooling water discharge mixing and transport at the ocean outfall are not to the agreed standard; and
- details of mangroves lost during construction or operation of the project and proposed rehabilitation programme.

2. Ground water and existing surface water hydrology

- a rehabilitation plan and closure strategy for the tailings dam.

Reports of the results of all monitoring programmes are to be submitted annually to the DEP for audit, and are to be made publicly available.

Recommendation 3

The Environmental Protection Authority recommends that the proponent should undertake a fauna field survey of the region with the view of appropriate rehabilitation as required, prior to the proposed plant being commissioned, in order to quantify the results of the desktop study detailed in the CER.

Recommendation 4

The Environmental Protection Authority considers that as a result of the increasing interest in industrial development in the Karratha to Cape Lambert area, surface air quality climatic data should be collected and a meteorological measurement network established so as to ensure accurate air quality computer modelling predictions can be performed for future proposals. Accordingly, the EPA recommends that government should establish a suitable meteorological measurement network and climatic data collection programme to achieve this objective.

6. Recommended environmental conditions

Based on the assessment of this proposal and recommendations in this report, the Environmental Protection Authority considers that the following Recommended Environmental Conditions are appropriate.

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and in response to issues raised following public submissions; provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

The Department of Environmental Protection will audit the implementation of the proponent's environmental management commitments (November 1995), which are published in EPA Bulletin 794 (Appendix 5).

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.

2-2 Where, in the course of that detailed implementation referred to in Condition 2-1, the proponent seeks to change those designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Proponent

These conditions legally apply to the nominated proponent.

3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

4 Environmental Management Programme (EMP)

4-1 The proponent shall prepare an Environmental Management Programme in two stages, as per the requirements of Conditions 4-2 and 4-3.

4-2 Stage 1 - before commissioning, the EMP shall address, but is not limited to the following:

Ocean cooling water intake and discharge

1. the nature and location of the intake and discharge points on the Robe River Mining Co Ltd jetty;
2. predict the ocean water quality, including water temperature change at and around the ocean outfall and compare it to an agreed water quality standard, including commitments (Appendix 5);
3. the sensitivity of the marine ecosystem to changes in temperature and the adequacy of a 4°C above ambient ocean water temperature discharge limit (Commitment 17 Appendix 5);
4. the method for determining the nature of the mixing zone;
5. baseline monitoring of environmental conditions at and around the ocean outfall; and
6. an oil/chemical spill contingency plan.

Ground water and existing surface water hydrology

7. the control of surface water, runoff, drainage and tailings dam such that the ground water is protected;
8. a water efficiency and conservation programme relating to the usage of fresh water; and
9. a monitoring and audit programme for ground water and surface water quality at and around the plant and tailings dam, with particular emphasis on iron as an indicator.

Gaseous emissions (including greenhouse gases and odours)

10. a monitoring and audit programme for all gaseous and odorous emissions (stack and ambient), including greenhouse gases;

11. calculations of the greenhouse gas emissions associated with the proposal (using appropriate methodology developed for Australia);

12. note the Governments desire to stabilise greenhouse gas emissions by the year 2000 and progressively reduce them thereafter. Also note the Revised Greenhouse Strategy for Western Australia 1994 and the United Nations Framework Convention on Climate Change (FCCC); and

13. the proponent shall use their best endeavours to comply with the Government position and FCCC Convention on greenhouse gas emissions and report on their progress.

Dust and particulate emissions

14. a monitoring and audit programme for all dust and particulate emissions (including fugitive dust) and the moisture content of storage stockpiles as a means of gauging the effectiveness of dust control.

Liquid and solid waste disposal

15. an inventory of the volume, contents and location of all waste disposal sites. These details shall be indicated on the site plan for future reference; and

16. details of waste disposal approvals obtained by the proponent from relevant government authorities.

Noise

17. a noise assessment for the overland conveyor.

4-3 Stage 2 - After commissioning, the EMP shall address, but is not limited to the following:

Ocean cooling water intake and discharge

1. verification that mixing and transport of cooling water at the ocean outfall meets the agreed standard;

2. rectification measures in the event that monitoring indicates that water quality, including cooling water discharge mixing and transport at the ocean outfall are not to the agreed standard; and

3. details of mangroves lost during construction or operation of the project and proposed rehabilitation programme.

Ground water and existing surface water hydrology

4. a rehabilitation plan and closure strategy for the tailings dam.

4-4 The EMP shall have clear environmental objectives based upon but not limited to the subject of items 4-2 and 4-3 above.

4-5 This EMP shall be prepared to the requirements of the Environmental Protection Authority on advice from the DEP.

4-6 The proponent shall implement the EMP required by Condition 4 (staged at appropriate times).

5 Fauna

5-1 The proponent shall ensure the protection of rare fauna within the project area.

5-2 To achieve the objective of Condition 5.1, the proponent shall conduct a fauna field survey with the view of appropriate rehabilitation as required, to the satisfaction of the Environmental Protection Authority on advice from the Department of Conservation and Land Management.

6 Decommissioning

6-1 The proponent shall carry out the satisfactory decommissioning of the project, removal of installations and rehabilitation of the site and its environs.

6-2 At least six months prior to decommissioning, the proponent shall prepare a decommissioning and rehabilitation plan to the satisfaction of the Environmental Protection Authority in order to achieve the objectives of condition 6-1.

6-3 The proponent shall implement the plan required by condition 6-2.

7 Time Limit on Approval

The environmental approval for the proposal is limited.

7-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Department of Environmental Protection that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years.

8 Audit and Review

To help determine environmental performance, periodic reports on progress in implementation of the proposal are required.

8-1 The proponent shall submit audit reports in accordance with an audit programme and to the satisfaction of the Department of Environmental Protection.

8-2 Each five years, the proponent shall submit a review of environmental protection, including but not limited to, the environmental objective and the audit of performance against the objectives.

The review shall be to the Environmental Protection Authority's satisfaction, upon advice from the Department of Environmental Protection. The environmental objectives may be changed by the Environmental Protection Authority following the review.

Procedure

1 Data arising from any future meteorological data collection in the Karratha to Cape Lambert area should be used by appropriate Government agencies in assessing the air quality performance of the proponent.

2 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

3 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The proponent is required to hold a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

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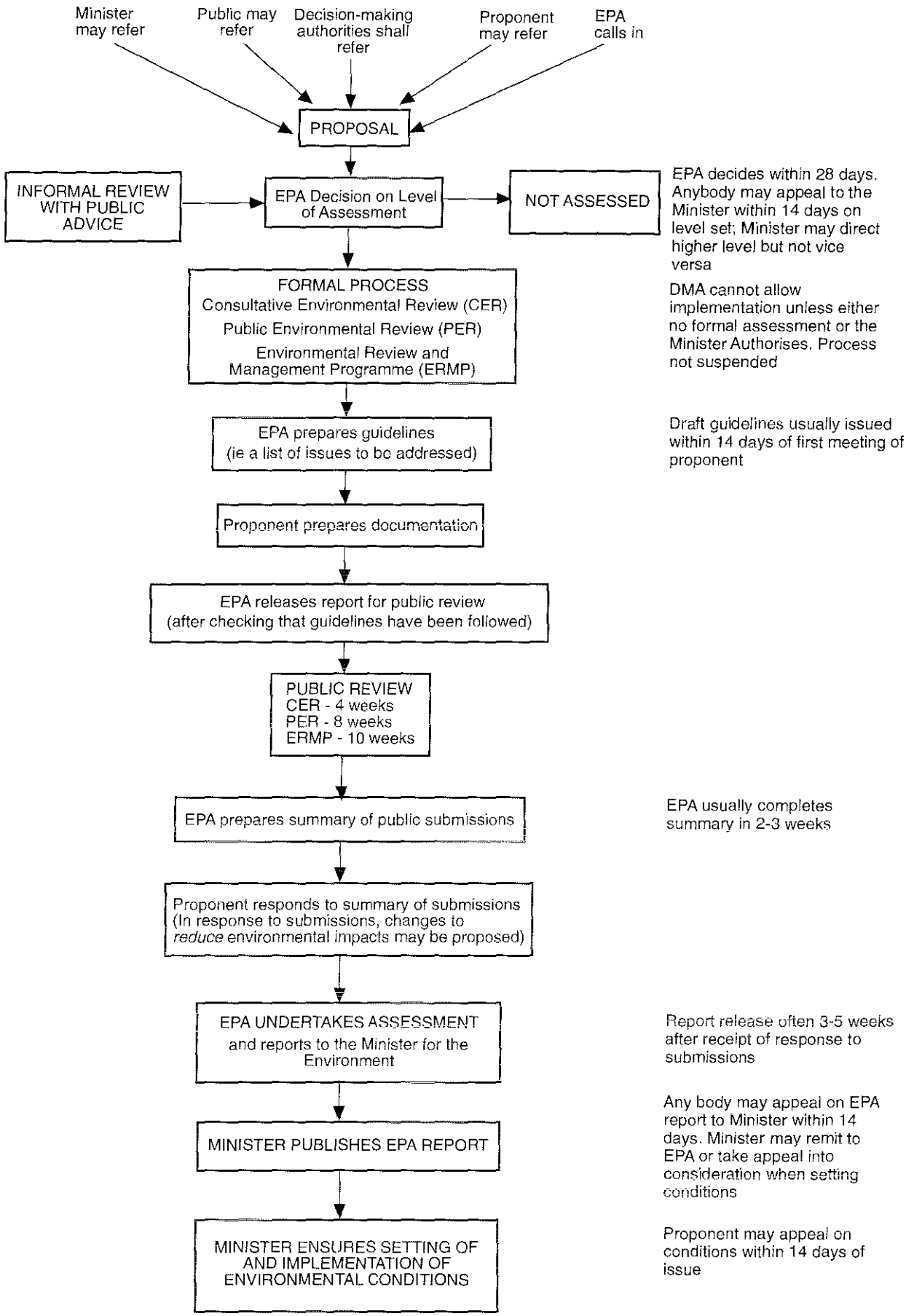
Appendix 1

Environmental impact assessment flow chart


Minister may refer
Public may refer
Decision-making authorities shall refer
Proponent may refer
EPA calls in
PROPOSAL
INFORMAL REVIEW WITH PUBLIC ADVICE
EPA Decision on Level of Assessment
NOT ASSESSED
EPA decides within 28 days. Anybody may appeal to the Minister within 14 days on level set; Minister may direct higher level but not vice versa
FORMAL PROCESS
Consultative Environmental Review (CER)
Public Environmental Review (PER)
Environmental Review and Management Programme (ERMP)
DMA cannot allow implementation unless either no formal assessment or the Minister Authorises. Process not suspended
EPA prepares guidelines (ie a list of issues to be addressed)
Draft guidelines usually issued within 14 days of first meeting of proponent
Proponent prepares documentation
EPA releases report for public review (after checking that guidelines have been followed)
PUBLIC REVIEW
CER - 4 weeks
PER - 8 weeks
ERMP - 10 weeks
EPA prepares summary of public submissions
EPA usually completes summary in 2-3 weeks
Proponent responds to summary of submissions (In response to submissions, changes to *reduce* environmental impacts may be proposed)
EPA UNDERTAKES ASSESSMENT and reports to the Minister for the Environment
Report release often 3-5 weeks after receipt of response to submissions
MINISTER PUBLISHES EPA REPORT
Any body may appeal on EPA report to Minister within 14 days. Minister may remit to EPA or take appeal into consideration when setting conditions
MINISTER ENSURES SETTING OF AND IMPLEMENTATION OF ENVIRONMENTAL CONDITIONS
Proponent may appeal on conditions within 14 days of issue

Appendix 2

Summary of submissions and proponents response to questions

Summary of submissions and proponents response to questions

1. MARINE IMPACTS

1.1 As the seawater used for cooling purposes will be discharged back into the ocean with a salinity level 4 times that of the surrounding seawater, will the discharge area at the port jetty become the habitat of fish and other marine creatures which prefer highly saline seawater such as coral trout and nor west snapper etc? Does the proponent recognise the potential impact that this might have on fishermen, as such species could be induced to leave nearby reefs and congregate near the discharge point which is in an area off limits to all fishermen?

We are unaware of any report or research publications which suggest that coral trout and NW snapper are attracted to highly saline seawater. To the contrary, there is evidence to suggest that adult reef fish would avoid seawater of over 45g/L. There are no reports of adult reef fish congregating around the outfall of existing brine discharges in the Pilbara. However, the volume to be discharged is so small (approx 50L/s) that it will be diluted to background concentration within a short distance of the proposed diffuser outfall. Therefore, it is highly unlikely that reef fish will occur within the mixing zone.

1.2 The potential impact of a storm event such as a cyclone surge on the coarse tailings dam seems to be understated in the CER, can the proponent elaborate on the reasons why? In view of the above, will the proponent review the reduced levels (RL's) of the top of the coarse tailings dam embankments?

The preliminary design of coarse tailings for surge protection was to protect the tailings from being eroded as a result of the 1 in 100 year storm surge event. As stated in Section 3.9.1.2 of the CER, the preliminary design was based on the methods recommended by CERC's 1977 Shore Protection Manual and the following principle parameters:

- ground elevation at the outside toe of the dyke ranges from +1.0m, above Australian Height Datum (AHD) to higher than +4.2m, AHD;
- a preliminary estimate of the 1 in 100 year total still water level of +4.2m, AHD;
- maximum wave height is 60% of the maximum still water depth;
- outside slope of dyke is 3 horizontal: 1 vertical; and
- rock armour size is based on, "No damage criteria and minor over topping".

The total still water level associated with the 1 in 100 year storm surge event was determined by WNI Pty Ltd and comprised the following:

- storm surge of 2.7m comprising:
  - inverted barometer effect 0.7m
  - geostrophic current set 1.0m
  - wave set 1.0m
- tide level of 4.7m above lowest astronomical tide (LAT) (Equal to 1.5m, AHD).

This estimate of total still water level is considered by WNI Pty Ltd to be accurate to within +/- 0.5m.

The CER concluded that the preliminary design estimate was likely to be conservative (ie. resulting in higher rock armour) as factors affecting the maximum wave height such as:

- the length of the fetch;
- the shape of the coastline; and
- the direction of travel of the ocean waves

were not considered in the analysis. The presence of Dixon Island and several sand dunes in the vicinity of the coarse tailing landfill presented in the CER are likely to significantly reduce the maximum wave height and the level of storm surge protection required. Therefore, the preliminary design presented within the CER is considered appropriate.

In any event, the current engineering design for the Project indicates that the coarse tailings dam will no longer be required. As such, storm surge protection of the coarse tailings dam is no longer an issue.

1.3 Has the proponent determined what impact a 4°C temperature difference between the discharged cooling water and surrounding seawater will have on the marine environment, particularly prawn and coral development, which are both dependent on temperature change in their breeding cycles? Has the proponent obtained expert advice in this regard from the Fisheries Department?

The issues surrounding the potential marine impact can not be fully investigated until the port site (and hence the location of the cooling water discharge) is finalised, as stated in Section 7.12 of the CER. The impact of the cooling water discharge will depend upon the sensitivity of the receiving environment and the Proponent has made a commitment (Commitment 16) to undertake an assessment of the proposed discharge location to assess this sensitivity. In the event that sensitive resources are identified, the Proponent will undertake modelling of the discharge plume to predict its impact and to design the discharge to minimise the impact on any such communities (Commitments 16 and 17).

The Proponent has also made a commitment (Commitment 17) to not discharge waters more than 4°C above the ambient ocean temperature. For the reasons stated above, the impact of this can not be fully assessed at this stage. However, the volume to be discharged is so small (approx 50l/s) that it will be diluted to background temperatures within a short distance of the proposed diffuser outfall. Therefore, it is highly unlikely that any impacts will occur beyond the mixing zone.

The Proponent believes that the implementation of Commitments 16 and 17 will ensure that the potential impacts of the proposed cooling water discharge will be fully assessed and will be acceptable.

1.4 Can the proponent provide more accurate details on heavy metal contaminants and their anticipated concentrations in the discharged cooling water?

Section 7.12.2 of the CER states that seawater will be cycled through a ceramic and fibreglass cooling tower and titanium heat exchangers. The seawater will be pumped through plastic or cement lined pipes to reduce corrosion. Therefore, the design of the system is such that any heavy metal contamination of the seawater would be very small. The Proponent is unaware of any water quality standards relating to titanium in ocean water. Nevertheless, the Proponent has made commitments (Commitments 18 and 19) to survey for toxic contaminants in the marine sediment and suitable marine biota from the area around the discharge. This testing would be conducted prior to commissioning and periodically during operations.

1.5 How will the presence of heavy metals and other contaminants in the discharged cooling water be monitored?

Samples of the cooling water would be taken and sent to a certified laboratory for testing of heavy metals and any other contaminants.

1.6 What action will be taken if monitoring indicates the presence of heavy metals and other contaminants such as anti foulant agents in the discharged cooling water?

In the event of heavy metal or other contamination being identified at levels likely to be of concern (as identified by national guidelines), AUSI would assist in determining the source of the contamination. If the AUSI Iron Project is found to be the source of this contamination then AUSI would identify the source within its plant. Once AUSI has identified the source it would be modified to ensure that the discharge criteria for the contaminants is met. AUSI would also undertake remediation of any areas which have unacceptable levels of contaminants due to its operations.

In the case of anti-foulant agents, the proponent has made a commitment (Commitment 19) to periodically monitor the concentrations of free chlorine in the ocean intake and discharge systems. The free chlorine levels in the marine discharge flow will be monitored continuously by AUSI to enable accurate dosing of the intake waters.

Due to the toxicity of chlorinated seawater, the EPA has set the following criteria for total residual chlorine (TRC) concentrations in seawater beyond the initial mixing zone of outfalls (EPA draft Water Quality Criteria for Marine and Estuarine Waters of Western Australia):

- no single TRC reading to exceed 10ppb (0.010mg/L); and
- six month medium TRC reading not to exceed 2ppb (0.002mg/L).

An alarm will be set to trigger when the concentration of free chlorine in the discharge marine water approaches half of the USEPA discharge criteria of 0.2mg/L for TRC. Section 7.12.2 of the CER indicated that a dilution ratio 50:1 should be easily achieved given the tidal regime of the area. This dilution will ensure that the guidelines for TRC are not exceeded beyond the mixing zone. In addition, the monitored data will be continuously analysed to detect any upward trend in the discharge concentration of free chlorine. This trend analysis will enable early detection of over-dosing. These measures should ensure that the levels of free chlorine beyond the mixing zone always remain below the acceptable discharge criteria.

1.7 Is the proponent prepared to make a commitment to undertake appropriate remedial action to ameliorate potential environmental impacts if contaminants are identified in the discharged cooling water?

As stated in the response to the previous question, in the event that unacceptable levels of contamination are identified and are shown to be attributable to the AUSI Iron Project, AUSI will:

- assist in the investigations to identify the source;
- undertake remedial action on its plant if it is the source of contamination; and
- remediate the impacted area if its plant is the source of contamination.

1.8 Will the proponent monitor coastal water quality? Is the proponent prepared to make a commitment to monitor coastal water quality?

AUSI has made a commitment (Commitment 19) to monitor for heavy metal and free chlorine concentrations in the ocean intake and discharge streams.

3.6 The proposed DR/HBI plant will generate large amounts of CO_2 which is a known greenhouse gas. Has the proponent given consideration to addressing the potential greenhouse effects of CO_2 emissions from the plant through means such as sink compensation for source generation (ie; planting trees etc)? Is the proponent willing to make a commitment to do so?

The production of HBI is an energy intensive exercise which results in a significant emission of greenhouse gas emissions. There are two major options available for Proponents to minimise the impacts of their carbon dioxide emissions:

- energy efficiency resulting in reduced emissions on a global perspective for the production of a similar product in another location; and/or
- sink compensation usually involving the planting of trees.

AUSI is aware of the potential problems related to carbon dioxide emissions and global warming and has made every effort to maximise the energy efficiency of the project. As stated in the CER, the proposed DR/HBI plant has been designed to maximise the effective usage of energy with the major energy efficient features being:

- the pellet plant recovers the burner off-gasses for use in the drying and preheating stages;
- the direct reduction shaft and HBI process recovers heat from the reformer flue gas and recycles it to the reformer by using it to preheat the reformer combustion air and the process gas which is reformed and sent to the shaft furnace; and
- gas based direct reduction processes are generally highly energy efficient as they produce metallic iron without using energy to melt the iron which occurs in the smelting process.

The energy efficiency of the project will decrease the overall carbon dioxide emission rate per tonne of HBI to a very low figure. For example it is estimated that the Project, operating at a maximum production rate of 3.6Mtpa, would emit a total of 2.8Mtpa of carbon dioxide which is equivalent to 0.78t of carbon dioxide per tonne of HBI. This rate of carbon dioxide production includes the carbon dioxide produced by the power station. On the other hand, the recently approved BHP HBI plant PER stated that its HBI plant (excluding the power station) would emit approximately 1.7Mtpa of carbon dioxide for its production rate of 2Mtpa HBI. This equates to 0.85t of carbon dioxide per tonne of HBI and excludes the carbon dioxide emitted by the power station.

Therefore, AUSI believes that it has a highly energy efficient project which will minimise the emissions of carbon dioxide as far as possible. Due to the commitment to high energy efficiency and reduced emissions on a global perspective for the production of a similar product in another location, AUSI do not wish to enter into sink compensation programmes.

3.7 In order to minimise the risk of having to carry out expensive modifications or overhauls of the plant in the future, has the proponent considered using a best practice approach on all emission concentrations, and designing the plant in a way which allows for substantial lowering of emissions in the future? Has the proponent ever given consideration to a zero emission goal being used as the basis for the plant proposal? What are the limitations on achieving that goal?

AUSI is utilising best practicable technology (as defined in the EPA Act) in the design of its plant. Factors affecting the choice of technology include minimisation of potential environmental impacts, cost, energy consumption, and product quality. AUSI believes that the technology currently available is not able to reach a zero emission discharge. Even if the technology were available on today's market, it would not be economically viable in the current world market. The achievement of a zero emission goal is primarily limited by the available technology.

1.9 Has the proponent considered the potential marine impacts from cathodic protection systems and coatings on pipelines and additional port/wharf facilities?

Cathodes, usually comprised of metallic zinc, are designed to corrode away in preference to the steel structures they are designed to protect. The rate of release of the oxidised zinc is slow and in waters subject to strong currents and tidal movements the potential for increase in the waters adjacent to the facilities is also low. An increase in the concentration of zinc in the sediments into the immediate vicinity of the structure may occur. The impact of such increases will depend upon the habitats and organisms present at the site where the facility is located. These will be fully investigated prior to construction (Commitment 16).

Coatings on submerged pipelines are mostly inert and include concrete and epoxy compounds. Antifouling compounds are generally only used on structures immersed for relatively short periods of times due to the need for re-coating at regular intervals which is generally not possible on permanently submerged structures. The coatings for the pipelines and any additional port/wharf facilities will be chosen on the basis of several factors including the potential impacts on the environment, its longevity and its cost. The DEP, CALM and Department of Transport will be consulted during this process.

1.10 The discharge of saline water into shallow embayments is of great local concern, particularly the local prawn fishery. Has the proponent consulted the Nickol Bay Fisherman's Association about early monitoring and management?

The Proponent has not consulted the Nickol Bay Fisherman's Association regarding early monitoring and management of the saline discharges. Primarily, this is a result of the uncertainty associated with the location of the Port site and thus the actual location of the saline discharge. However, the quantity of water being discharged is so small (approx 50L/s) that it will be diluted to background salinity and temperatures within a short distance of the proposed diffuser outfall. Therefore, it is highly unlikely that any impacts will occur beyond the mixing zone.

1.11 To facilitate the gathering of accurate baseline monitoring data on the marine environment in the vicinity of the cooling water intake and discharge streams, should not Commitment 18 state that sediments and oysters will be sampled for a period prior to commissioning? Is the proponent willing to amend Commitment 18 in this regard? If not, why not?

The primary reason that AUSI has made Commitment 18 is to obtain sufficient information on the status of the receiving environment before its operations commence and to monitor the potential impacts of the plant. Further, Commitment 18 also states that in the event that unacceptable levels of contamination are identified, AUSI will assist in the investigations and if its plant is shown to be the source, undertake remedial action on both the plant and the impacted area.

Potential heavy metal contamination is of interest primarily due to its toxicity and the fact that it accumulates in the receiving environment rather than being dispersed. Therefore, a long term programme to gather baseline data on the existing concentrations of toxic contaminants is not considered necessary.

Commitment 18 states that the monitoring programmes will be established to the reasonable requirements of the Minister for the Environment.

1.12 The proposed site is adjacent to Dixon Island, which is listed in the Register of the National Estate as part of the Islands from Dixon to Cape Keraudren listing. The islands are significant as seabird, turtle and dugong habitat. Has the proponent considered the potential impact of the project on this habitat?

At its closest point, the plant is approximately 3km from Dixon Island. Due to the nature of the plant and the type/nature of the discharges it is not anticipated that the Project will have any significant impact on Dixon Island and its habitats.

In the event that the negotiations with Robe River regarding the use of the existing Cape Lambert facilities fail, a new Port site will have to be found and undergo assessment. Should this occur and the proposed Port site is in the vicinity of Dixon Island then the potential impacts of the development on Dixon Island would be investigated.

1.13 Is the proponent willing to make a specific commitment to prepare an oil/chemical spill contingency plan? If not, why not?

AUSI believes that it is impractical and inappropriate for it to prepare its own oil/chemical spill contingency plan. However, AUSI is prepared to participate and contribute to an integrated contingency plan for the area.

2. IMPACT ON GROUND WATER AND EXISTING SURFACE HYDROLOGY

2.1 Has the proponent considered the potential impact on mangroves from changes to the local ground water regime (ie. salinity, flowrates and flow directions etc) due to the presence of tailings dams near the coast? How will this potential impact be managed?

The AUSI Iron Project now only requires the fine tailings dam. Section 7.8 of the CER stated that the potential of the project to impact on the ground water is small as a result of:

- the benign nature of the tailings which will contain only shale, low grade iron ore and fresh water. No chemicals will be added during the concentration of the iron ore;
- the design of the fine tailings pond, which will facilitate water recovery;
- the expected low permeability of the tailings areas; and
- the lack of any known ground water resource of any significance in the immediate vicinity of the area.

The tailings dam will not be designed to stop leakage, although every reasonable effort will be made to maximise the recovery of water from the dam. Leakage from the fine tailings dam is not expected to result in any unacceptable impacts on the mangroves in the area. The water from any leakage will essentially be fresh as no chemicals are added during the concentration process. As such, any leakage will not contain any significant contaminants or nutrient loadings.

It is considered unlikely that the tailings dam will result in a rise in the ground water table due to:

- the low volume of water discharged into the dam;
- the recovery of excess water for re-use in the process; and
- the high evaporation rate.

It is therefore concluded that the Project will not result in any significant or unacceptable changes to the ground water regime or the mangrove communities in the vicinity of the project area. As such, monitoring will not be required.

2.2 How does the proponent intend to ameliorate potential impacts during construction as a result of contaminants which may be present in surface runoff?

Section 7.5 of the CER discusses the potential impacts of the Project on the surface hydrology of the project area. While the management measures discussed within this section primarily relate to the operational stage of the plant, they will also be applied to the construction phase of the project where practical. In particular, the impacts due to

erosion and sedimentation will be mitigated by construction of sedimentation ponds and other erosion control procedures.

2.3 Why didn't the proponent address management strategies with respect to water conservation? In view of the above, is the proponent prepared to make a commitment to implement an auditable water efficiency and conservation programme to the satisfaction of WAWA and the Minister for the Environment?

AUSI is very aware that water is a valuable resource in the Pilbara region. As a direct result, the Project has been designed to minimise its consumption of water and details of these methods are presented within Section 3.11 of the CER. For example, the HBI plant has been designed to reduce the freshwater consumption from approximately 1.5m^3/t HBI for conventional HBI plants with freshwater evaporative cooling towers to less than 0.5m^3/t HBI for the proposed plant.

However, as water is a valuable resource, AUSI would be happy to carry out an auditable water efficiency and conservation programme relating to its usage of fresh water.

2.4 In the CER Commitment 4 states that "the proponent will establish a programme to periodically monitor total dissolved solids, total suspended solids, pH and conductivity in the principal tributary prior to its discharge". Can the proponent provide details on where the actual discharge point will be located together with its configuration?

The proposed location and configuration of the discharge point is currently unknown as the detailed engineering design of the plant is not yet completed. It is planned that the surface water discharge from the site will occur via existing streams, where possible. Therefore, it is likely that the monitoring programme would be undertaken within existing streams towards the edge of the Project Area and downstream of the sedimentation ponds.

2.5 Will the proponent monitor ground water quality at the perimeter of the DR/HBI plant and its associated tailings dams? Is the proponent prepared to make a commitment to undertake such monitoring?

AUSI will make a commitment to monitor the ground water quality at the perimeter of the Plant area and the fine tailings dam as follows:

COMMITMENT 24

Prior to commissioning, the Proponent will establish a ground water monitoring programme to record the water quality and depth of the water table at the perimeter of the Plant area and the fine tailings dam. The monitoring programme will be designed to monitor water quality both upstream and downstream of the tailings dam on a quarterly basis. The monitoring programme would be designed and implemented to the reasonable satisfaction of the Minister for the Environment.

2.6 The erosion of tailings dam walls through gullying and piping as a result of extreme rainfall events and/or poor tailings management over a period of time, is a common occurrence in the Pilbara region. How will the proponent manage this potential impact?

AUSI is committed to progressively rehabilitating disturbed areas (including the tailings dam) to facilitate erosion control and revegetation (Section 7.18 of the CER). In addition, AUSI is committed to minimising the off-site transport of sediments through the use of sedimentation ponds, the minimisation of exposed surfaces and identification and treatment of on-site areas with erosion potential (Commitment 5). This commitment will apply to the tailings dam.

3. AIR EMISSIONS

3.1 It is understood that the sulphur content of iron ore varies considerably depending on the location of its source. What affect will this have on the predicted levels of SO_2 and H_2S emissions from the DR/HBI plant? How will the proponent address this concern?

The emissions of sulphur dioxide are proportional to the sulphur content of the iron ore. The emissions of hydrogen sulphide will depend to a large extent upon the chosen Direct Reduction technology (Midrex or HYL). If HYL is chosen, then the emissions of hydrogen sulphide will also increase due to the increased sulphur into the system.

The air dispersion modelling has been undertaken using the maximum expected sulphur content in the iron ore (0.02%). Therefore, the predicted impacts of sulphur dioxide and hydrogen sulphide are likely to be conservative.

The supplier of the iron ore will have a contractual agreement with AUSI to ensure that the iron ore is within the required specifications. These specifications will include the sulphur content.

3.2 Can the proponent provide some indication of the sulphur content its supplied iron ore will have in the medium to long term and how changes in sulphur content will be accommodated?

Table 3.1, presented in Section 3.0 of the CER states that the expected range of sulphur in the ore is 0.01 to 0.02%. The medium sulphur content of the fine and lump ore is 0.016% and 0.011% respectively.

As stated in the response to the previous question, the modelling was conducted using the maximum expected sulphur content (ie. 0.02%). Therefore, the predicted impacts are likely to be conservative as the actual sulphur content of the ore is generally expected to be less than 0.02% based on the medium sulphur content of less than 0.016% (depending upon the ore type).

3.3 As there is no suitable climatic data available for the project area to allow accurate modelling to be performed, how can the proponent guarantee that air emissions from the DR/HBI plant will not exceed recommended guideline levels? What corrective measures will be implemented if these guideline levels are exceeded once the operations commence?

Section 7.6.4 of the CER stated that the meteorological data used for the modelling was not ideally suited for this use. However, no better site specific data could be obtained for use in this study. As a result of the inadequacies of the meteorological data, a number of different models were used to predict the ground level concentrations of pollutants over the full range of expected meteorological conditions. With the exception of the predicted concentrations of hydrogen sulphide, all of the predicted ground level concentrations were well below the recommended criteria. Based on the conservative nature of the modelling together with the use of the maximum expected emission rates, it was concluded that the air quality impacts of the plant would be acceptable.

In the event that the guideline levels presented within the CER are exceeded in residential areas as a result of the AUSI Iron Project, AUSI will modify its plant to enable the guidelines to be met.

3.4 There is likely to be strong local community intolerance to black smoke emanating from flaring operations at the plant. Has the proponent given appropriate consideration to designing flaring systems for smokeless operation even under upset conditions?

Smokeless flares are common around the world today and AUSI intends to utilise such a flare for the AUSI Iron Project.

3.5 Section 3.6.2 of the CER states that most of the sulphur in the iron ore is removed in the firing of the pellets. This is confirmed in Table 3.3 of the CER where 70kg/hr of SO_2 is emitted through a hood/windbox exhaust of 1.8Mm³/hr. The theoretical level of SO_2 through the exhaust is 39mg/m³. However, SO_2 emission rates are supposedly based on worst case iron ore sulphur contents of 0.02%. The figure quoted in Table 3.3 of the CER is 70kg/hr, yet based on an annual throughput of 7 million tpa of ore (Table 3.1 of the CER) the SO_2 production should be 330kg/hr based on 350 days operation at 24hrs/day. Any change in SO_2 output would affect the maximum predicted ground level concentrations of SO_2 under upset conditions of 104µg/m³ (Table 7.7 of the CER). Can the proponent clarify this apparent discrepancy in the amount of SO_2 produced? Can the proponent also explain how and why the predicted ground level concentration of SO_2 under normal conditions is higher than under upset conditions?

Table 3.1 of the CER lists the approximate composition, annual usage and production rates for raw materials and the product. This table shows that a total of 6.3 million tonnes per annum (Mtpa) of iron ore with a sulphur content of 0.01 - 0.02% will be used by the plant. Figure 3.4 indicates that approximately 4.66Mtpa of this ore will be fines, with the remaining 1.65Mtpa being coarse or lump ore. Figure 3.4 also indicates that the fine ore goes through a concentrator with approximately 1.31Mtpa going to the tailings dam. Oversized ore from the concentrator goes directly to the Direct Reduction shaft furnaces. Therefore, the pellet plant only receives approximately 3.3Mtpa of fines.

The pellet plant produces spherical pellets of approximately 18mm in diameter which contain cellulose based organic binders and metallurgical additives. The "green" pellets are passed through an induration furnace which removes approximately 40% of the sulphur contained in the ore. The temperature of the induration furnace is such that the Direct Reduction shafts remove very little of the remaining sulphur from the pellets, however, some sulphur is released during the reduction of the lump ore. The HBI product (reduced pellets and reduced lump ore) contains the remaining sulphur. Table 3.1 of the CER shows that the HBI product can contain up to 0.1% sulphur.

With regards to the issue of the maximum predicted ground level concentrations of sulphur dioxide occurring under normal operating conditions, Tables 3.3 and 3.4 of the CER presented the expected emission rates of sulphur dioxide for these scenarios. All of the upset conditions identified and presented within Table 3.4 resulted in a decrease in the overall sulphur dioxide emission rate from the plant primarily due to the shutdown of one or more components of the plant. Without these components operating, the total sulphur dioxide emission rate decreases and hence the predicted maximum ground level concentrations of sulphur dioxide decrease. Therefore, as stated in Section 7.6.5 of the CER, the maximum ground level concentrations of sulphur dioxide are predicted to occur under normal operating conditions when the maximum emission rate of sulphur dioxide is predicted to occur.

The use of Direct Reduction (DR) and Electric Arc Furnace (EAF) technology represents a significant reduction in the emissions that occur when compared to conventional steel making processes. In addition to the decreased emissions, DR and EAF technology result in a significant reduction in the energy requirements of steel production.

4. DUST

4.1 In Commitment 12 it is stated that "The Proponent will monitor ambient dust concentrations in the event that dust complaints relating to the Project occur." Why doesn't the proponent consider it necessary for baseline monitoring to be performed and subsequent data be made available prior to complaints occurring? Why has Commitment 12 been made conditional in the event of complaints occurring? Is the proponent prepared to make a commitment to undertake baseline monitoring of ambient dust levels and to implement an on going dust monitoring programme, regardless of whether or not complaints occur?

Sections 3.7.3 and 7.6.8 outlined the methodologies that would be used by AUSI to minimise its dust emissions. Commitment 9 states that the Proponent will minimise dust emissions during operation of the facility by the following measures:

- maintain a landscaped perimeter around the facility;
- use of particulate scrubbing equipment;
- covering of conveyor transfer points;
- regular cleaning of areas likely to accumulate dust;
- sealing of major roadways; and
- use of water sprays on stockpiles.

AUSI believes that it is more appropriate to focus its attention on the minimisation of dust emissions from the Project rather than undertake a regular monitoring programme. AUSI expect that impact of any fugitive dust emissions will be small due to the plant design and the proposed control measures and as such an ongoing monitoring programme is not warranted. However, AUSI is prepared to modify Commitment 12 to undertake periodic dust monitoring in the vicinity of the plant as follows:

COMMITMENT 12

The Proponent will monitor ambient dust levels in the vicinity of its plant on a quarterly basis. A dust deposition monitoring programme would be established to record the dust deposition on a quarterly basis. In addition, ambient dust concentrations will be monitored in the event that dust complaints relating to the Project occur. The monitoring programme will be conducted to the satisfaction of the Minister for the Environment.

5. LIQUID WASTE DISPOSAL

5.1 Why has the proponent made no commitment in relation to the management and disposal of waste oils, solvents and other toxic materials? Is the proponent prepared to make such a commitment?

Sections 3.9.2 and 7.9.1 of the CER describe the methods proposed for the disposal of waste oils and solvents. AUSI has a legal responsibility to dispose of these wastes in an approved manner and so a specific commitment is not required.

5.2 Although the proponent has indicated that it would be using fresh water that may be treated with an oxygen scavenger such as sodium metabisulphite to prevent internal corrosion of plant pipework, in the event of this water not being reused, no mention was made of where this waste water would be discharged if it had to be. How does the proponent envisage disposing of this contaminated waste water if it needs to?

As stated in Section 7.9.1 of the CER, an oxygen scavenger may be added to water used for the hydrostatic testing of pipelines prior to the commencement of the operations phase. The quantity of water used for this purpose is expected to be small and would be collected and re-used where practical. In the event of a discharge, the treatment chemicals break down to benign compounds upon exposure to air. Therefore, it is not expected that this water will result in any unacceptable impacts, nor will it require any special management procedures.

5.3 Is the proponent intending to maintain an inventory of the volume, contents and location of all waste disposal sites? If not, why not?

During the operation of the Project, only one main disposal site, being the fine tailings dam, will be utilised. AUSI will maintain an inventory of the quantity of fine materials deposited within the dam.

5.4 Can the proponent provide more accurate details on the long term scenario for tailings disposal? How will tailings be managed after the plant is decommissioned?

AUSI believes that the fine tailings dam will be sufficient to meet the long term requirements for tailings disposal. Following decommissioning, the fine tailings dam will be rehabilitated as presented in Section 7.18.4 of the CER. The fine tailings are benign and will contain low grade ore similar to that found all over the Pilbara. The concentration of ore is performed in fresh water with no chemical additives, so the tailings will not contain any residual process chemicals (see Section 3.9.1.1 of the CER). Therefore, it is envisaged that the management of the tailings following decommissioning will not be a major issue following rehabilitation.

5.5 The CER makes predictions about the volume of fines produced over a twenty year period, yet there is no allowance for increasing production rates over that period. Similarly, there is no prediction made about coarse tailings requirements over a twenty year or longer period. Has the proponent given these points any consideration?

AUSI no longer has a requirement for the coarse tailings storage facility. The predictions of tailings quantities presented in the CER are based on the typical ore composition expected to be supplied for a total production rate of 3.6Mtpa of HBI. Factors that can affect the quantity of tailings include:

- the quality of the ore; and
- the production rate of HBI.

The planned capacity of 3.6Mtpa represents the maximum capacity expected from the three Direction Shaft Furnaces that will be used in the process after optimisation. Therefore, to significantly increase the capacity of the plant, additional Direct Reduction Furnaces would be required. Such an expansion (eg. 3.6 to 4.8Mtpa) will require an additional environmental assessment which would include the treatment of increased tailings.

6. NOISE

6.1 Table 1 of the CER indicates that the proponent intends to monitor the noise levels of the overland conveyer on a regular basis. However, the proponent has made no attempt to predict the noise levels of the operating conveyer and its impact on Wickham residents. Can the proponent explain why it has not done so? Since it would be too late

determining that there is a noise problem after the conveyer is built and operating, is the proponent willing to undertake further studies to predict potential noise levels? If not, why not?

"Section 7.7.5.3 states that it is expected that the noise impact from the belt conveyer will be small with the most significant impacts associated with the transfer points. The Proponent will enclose the transfer points to minimise the noise impacts from these sources. As stated in Section 7.7.5.3 the Proponent will also undertake surveys along the conveyer's length to ensure that its noise emissions are minimised. The proponent has made a commitment (Commitment 13) to undertake remedial measures in the event that noise levels attributable to the project (including the conveyer) exceed the EPA criteria."

"The noise impacts of the conveyer were not modelled within the CER as the exact location of the conveyer route will not be known until agreement on the port design has been reached. The Proponent's preferred position, as stated within the CER, is that the existing Cape Lambert facilities be used for the project and the negotiations with Robe River are still continuing in regards to this. The Proponent has made the commitment (Commitment 15) to complete an assessment of the potential impacts of the port site and its associated infrastructure (including the conveyer) once these issues have been resolved."

7. SOCIAL ISSUES

7.1 A significant number of business people in Roebourne believe that the township has largely been overlooked by the proponent as a beneficiary of downstream economic development resulting from the AUSI Iron Project (particularly in relation to service and support facilities for the anticipated 1600 strong construction workforce and the 280 operational workforce). It seems apparent to them that Wickham, Karratha and Point Samson will benefit the most from this project. How does the proponent respond to this point of concern?

AUSI believe that the Project will benefit the whole region including Roebourne through the increased use of services and facilities in the region. In addition to this flow-on economic growth, the Project will provide employment and training opportunities as well as opportunities for local contractors to provide commercially viable services. Consultation between AUSI and the Ieramungadu Group and the Nanga-Ngoona Moore-Joorga Land Council resulted in Roebourne being left off the list of towns likely to be used for housing the construction and operational workforce. However, AUSI has no objection to considering the town of Roebourne (in addition to Wickham, Karratha and Point Samson) as a location for workforce accommodation should this meet with the approval of Roebourne's existing residents.

7.2 The protection of areas of importance to aboriginal people was identified as a key issue in the CER Guidelines. Without public airing of the survey report in the CER, there is no way the community can be properly informed or involved in the decision making process in relation to the potential impacts of the project on the Pilbara region. How does the proponent respond to this point of concern?

AUSI has had extensive consultation with the Ieramungadu Group and the Nanga-Ngoona Moora-Joorga Land Council who represent the Aboriginal people with a traditional affiliation with the Project area. The consultation was conducted through the Ieramungadu Group. The consultative survey took one month to complete and involved meeting a wide cross-section of the Aboriginal community from Port Hedland to Onslow. The final report prepared by the Ieramungadu Group was endorsed by the Nanga-Ngoona Moora-Joorga Land Council.

AUSI has made a commitment (Commitment 20) to undertake an ethnographic and archaeological survey of the project area and obtain all approvals required by the *Aboriginal Heritage Act (1972-1980).*

7.3 Paragraph 3.17.1 of the CER states that during construction some 1600 workers will be accommodated in a temporary construction camp and in existing caravan parks. Why didn't the CER discuss the social impact of this influx of people and whether or not existing caravan parks could adequately cater for this number of personnel?

Section 7.16 of the CER presented the findings of the Pilbara 21 Strategy Plan which noted that Karratha is an appropriate location for the accommodation of a construction workforce, and that the region overall has a good record in successfully addressing the needs of construction workforces.

In addition, Section 5.2 of the CER reported that the utilisation of community facilities in the Roebourne-Wickham-Point Samson area is relatively low based on information supplied by the West Pilbara Health Service.

Finally, The CER states that a temporary construction camp will be required. It is apparent therefore, that the existing caravan parks do not have enough capacity to cater for the entire construction workforce.

7.4 Paragraph 3.17.2 states that the operational workforce will be accommodated in existing or new housing in Karratha, Wickham or Point Samson. Can the proponent clarify whether or not Wickham and Point Samson have adequate infrastructure and resources to enable them to be used for the additional accommodation requirements? Can the proponent provide additional information as to how the workforce will be accommodated?

Section 5.1 of the CER stated that as of June 1991, the population of the Shire of Roebourne was estimated to be 17,294. Data supplied by the Shire of Roebourne (Figure 5.2 of the CER) indicates that the population had declined to 14842 by the end of 1994. The CER also stated that the Shire of Roebourne were expecting moderate population growth in the short to medium term due to the current economic revival and stabilisation of local employment opportunities. Projects such as the AUSI Iron Project will be significant contributors to this expected growth. Therefore, the population figures and the Shire of Roebourne both support the belief that the Project workforce can be accommodated within the Shire.

7.5 The Executive Summary of the CER infers that the proponent has been in consultation with the community regarding the development of this project. Has the proponent held any discussions with a representative group of residents in Wickham on the likely impact of the project on their community?

Section 6 of the CER presents details on the organisations contacted regarding the AUSI Iron Project. The Shire of Roebourne, which represents the towns of the Shire including Wickham, was consulted extensively about the Project. AUSI also established a public display in the Wickham Community Library for the majority of the public review period.

7.6 As the proposed plant will be in close proximity to Dixon Island and others, has the proponent assessed the cultural significance of these islands?

It is not anticipated that the Project will have any impact on Dixon Island's cultural significance as Dixon Island is approximately 3km from the proposed development.

8. FLORA AND FAUNA

8.1 Why was there no fauna field survey conducted in the project area?

It is common practice to undertake desktop studies rather than a field survey to assess the environmental impacts of a Project on the fauna species and habitats of a project area where:

- there is a reasonable amount of existing information on the fauna of the coastal region;
- the fauna habitats in the project area are widespread throughout the region (ie. the habitats are unlikely to be restricted to the project area or regionally significant);
- the project area occurs in a wide zoogeographic region, and the fauna tends to be highly mobile and unlikely be dependent on the habitats in the project area; and
- the Project is unlikely to cause significant disturbance to fauna species and habitats.

Therefore, the approach adopted for the fauna study was to undertake a desktop study using the habitats identified during the flora and vegetation field surveys and the available literature for the area. Section 4.8.1 reported that no endemic species were likely to be limited to the project area or adjacent areas and would not be affected by the Project. It was also reported that the fauna habitats of the project area are not considered to have any unique qualities nor are they considered to be of special regional significance.

A similar survey of the rail crossover also found that the project would not have a significant impact on the fauna of the area as they tend not to be habitat specific and have widespread distributions (Section 4.8.2 of the CER).

The results of the desktop studies and discussions with CALM and the Western Australian Museum indicated that it was not necessary to undertake field work to further investigate the fauna of the area.

8.2 The CER identified the Ghost Bat (Macroderma gigas) as possibly occurring in or adjacent to the project area (Appendix C, page C-26) but did not identify its conservation status. This species is listed as Vulnerable in Schedule 1 of the Endangered Species Protection Act 1992 (ESP Act). Can the proponent clarify this point of concern?

The Ghost Bat is protected under Schedule 1 and this was inadvertently omitted from the Appendix.

8.3 The CER states that as the vegetation and vertebrate species identified in the region have wide distributions throughout the Pilbara, they are not considered to be of particular significance. This statement can lead to the misconception that widely distributed species and communities are secure and need no attention paid to their conservation. Such perceptions can be misleading however, as many widely distributed species are of conservation concern. The Mulgara is an example. This species is widely distributed across the arid-zone, but occurs with such irregularity and in such low numbers that it is listed as Vulnerable in the Endangered Species Protection Act 1992 (ESP Act). How does the proponent respond to this point of concern?

The statement quoted from the CER was intended as a summary which stated that the flora and fauna of the Project area were widely distributed and common throughout the Pilbara. In reaching this conclusion, the conservation status of species found (in the case of flora) and thought to be in the area (in the case of fauna) were taken into consideration as indicated within the CER. To not consider these issues, as suggested by the question, would be irresponsible.

8.4 The CER identified 11 species of migratory birds that may occur in the project area. All of these species are listed under the Japan-Australia Migratory Birds Agreements (JAMBA and CAMBA), in which Australia is obliged to protect the habitat for species listed under these agreements. In view of the above, will the proponent's EMP incorporate measures to minimise the impact on these migratory species, such as appropriate seasonal timing of construction activity and the use of environmentally sensitive plant lighting etc?

Table 4.6 of the CER and its associated notes identified the migratory birds that are protected by the JAMBA and CAMBA and may occur in the Project area. The comments provided within this table state that the Project area does not contain any major habitat suitable for 10 of these 11 species. The eleventh species, being the Rainbow Bee-eater, was also presented in Table 4.6 of the CER and is considered to be a resident, a winter visitor and a passage migrant in the Pilbara. It is moderately common throughout Western Australia and it is considered that the proposed development is unlikely to have a significant impact on its distribution or conservation status.

9. RISKS AND HAZARDS

9.1 There are two main risk scenarios associated with the proposal. These are:

- **explosion of a flammable vapour cloud; and**
- **a hot metal explosion.**

Will the proponent conduct a HAZOP prior to the final design and commissioning of the plant, and a Hazardous Zone classification for various areas of the plant?

AUSI will conduct a HAZOP and have hazardous zone classifications for areas of the plant. This is a standard practice for this type of industry.

9.2 Can the proponent provide more information on the hazards associated with dimethyl disulphide? This compound has a strong offensive odour, a moderate toxicity rating and a serious fire hazard rating. Is the proponent aware that non-sparking ventilation systems and electrical equipment would be required in storage areas?

The qualitative risk assessment (Section 8.0 of the CER) states that dimethyl disulphide (DMDS) is the only hazardous chemical likely to be stored on site in significant quantities. The qualitative risk assessment concluded that DMDS should not present a

significant off-site risk and precautions regarding its use were recommended (Section 8.3.3).

AUSI will comply with all of the legal requirements relating to the safe handling and storage of DMDS.

10. OTHER ISSUES

10.1 Has the proponent sought consultation and input from the regional offices of the Department of Environmental Protection (DEP) and CALM on the scope and content of its environmental commitments? If not why not?

Consultation with the regional offices of the DEP and CALM was undertaken on a formal and informal basis throughout the preparation of the CER. This consultation included a briefing meeting between the DEP, CALM and AUSI, and a follow-up meeting between the DEP and AUSI. Unfortunately, CALM was unable to the second meeting. The objectives of these meetings were to:

- identify the main regional and site-specific environmental issues of concern to these government departments; and
- discuss the development of appropriate environmental management strategies and procedures.

Similar meetings were also held with CALM and DEP offices based in Perth. Table 6.1 of the CER presents a summary of the main issues discussed during these meetings.

The DEP distributed a draft of the CER to various Government departments for their review prior to finalisation and release of the CER for public review. This draft contained the commitments for the Project. Therefore, these agencies had an opportunity to provide comment on the scope and content of the commitments at an early stage. Further discussions regarding the commitments were conducted with the nominated Assessment Officer at the DEP's Perth office.

10.2 Where will the limestone and dolomite required by the DR/HBI plant be sourced from? Are there any potential environmental impacts associated with the supply of these materials?

The source of the limestone and dolomite is unknown at this stage. The environmental and other responsibilities associated with the supply of the raw materials will rest with the supplier.

Appendix 3

List of submitters

Mrs/Ms S Starr
Mr P Hancox
Mr L Bassanese
Mr/Mrs/Ms V R Parker
"Give Roebourne a fair go" petition letter with 22 participants
Robe River Iron Associates
BHP (Pilbara Energy Project)
WAWA
Conservation Council of Western Australia Inc
Australian Nature Conservation Agency
Australian Heritage Commission
Department of Minerals & Energy WA
Department of Conservation and Land Management
Fisheries Department of WA

Appendix 4

Proponents Project Description

Proponents Project Description

From Chapter 3 of the CER. Refer to CER for all Figures that are mentioned in the text below.

3.1 PLANT LAYOUT

The major components of the proposed development are:

- iron ore concentrator;
- iron ore pellet plant;
- DR/HBI plant;
- raw material and product handling systems;
- port facilities;
- power generation facilities;
- maintenance and administration facilities; and
- the rail crossover.

The proposed layout of the plant site is illustrated on Figure 3.1 and a three dimensional perspective view of the plant is presented on Figure 3.2.

3.2 RAW MATERIALS AND PRODUCT

The primary raw materials required for this project are:

- iron ore;
- limestone and dolomite;
- organic binders;
- natural gas; and
- water.

The project product is HBI, which will be exported to customers from the port.

The approximate composition and usage or production rates for all raw materials (except natural gas and water) and HBI are presented in Table 3.1.

3.2.1 Iron Ore

It is proposed that the iron ore would be supplied by a number of existing mines in the form of lump and fines and would be transported to the DR/HBI plant via existing railway lines. The current proposal would utilise a maximum of 25% lump ore.

3.2.2 Limestone and Dolomite

Limestone and dolomite will be used as metallurgical additives during pelletising to help bind the ground ore into strong pellets. Calcium oxide and magnesium oxide from the calcined limestone and dolomite are also required in the HBI by steelmakers to neutralise the acidic gangue (waste) materials from the ore (mostly SiO_2) in the slag formed during steelmaking (ie. the next processing stage where the HBI is converted to steel).

TABLE 3.1
APPROXIMATE COMPOSITION, ANNUAL USAGE AND PRODUCTION RATES FOR RAW MATERIALS & THE PRODUCT

Composition and Rate	Iron Ore	Limestone	Dolomite	Organic Binders	HBI
Rate of Use					
Tonnes/year	6.3 million	60,000	11,000	3,000	
Rate of Production					
Tonnes/year					3.6 million
Composition					
%Total Fe	60-63 as oxide	0	0		90-92
% C	0	0	0		0-2
% SiO_2	3-5	0-10	0-2		1-3
% Al_2O_3	2-3	0-1	0-1		0.5-2
% CaO	0	0-1	0-5		0.5-1.5
% $CaCO_3$	0	85-95	50-70		0
% MgO	0	0-0.5	0-2		0-0.2
% $MgCO_3$	0	1-5	30-50		0
% S	0.01-0.02	0-0.1	0-0.05		<0.1
% H_2O	2.5-4.5	0-5	0-5		0

3.2.3 Organic Binders

Organic binders are cellulose-based products used to assist with binding the ground ore during pellet production. The binder is burnt out of the pellets during firing and is classified as a low toxicity product. Estimated rates of usage are shown in Table 3.1 and these will be confirmed by test work with the actual feed material for the pellet plant.

3.2.4 Natural Gas

Natural gas is reformed (see Section 3.6.1) and used for the reduction of iron ore to HBI and it is also used for the power station. The natural gas will be piped to the plant from the North West Shelf Gasfields. Technically proven reserves of gas in these fields total 12.5 trillion cubic feet and it is expected that total reserves far exceed the proven reserves. Other smaller sources of natural gas exist in onshore fields and offshore fields closer to the coast.

Preliminary discussions with several gas producers/developers are expected to confirm that the quantity of natural gas required to support this DR/HBI project could be made available at an economic price, at the required peak flow rate and with adequate supporting reserves.

The estimated gas requirement for this DR/HBI project is a maximum of 1.2 x $10^9 m^3$ per year or 6,152GJ/hr.

3.2.5 Water

The proposed plant will consume approximately 3.3 million cubic metres per year (Mm^3pa) of fresh water. This water will be supplied from either the Harding River Dam/Millstream system or an alternative supply. Discussions with WAWA have indicated that there is sufficient resource available in the region although additional headworks for the Harding River Dam or the development of the Fortescue borefield may be required.

The plant will also use approximately 5.4Mm^3pa of seawater for the cooling circuit, with some 1.4Mm^3pa of brine being returned to the ocean.

3.3 MATERIALS HANDLING SYSTEMS

The materials handling systems is an important part of the DR/HBI facility. State-of-the-art systems will be employed which will permit remote operation, close feed control and reduced operating labour requirements. Table 3.2 presents a summary of the source of raw materials, transport details and product storage details.

TABLE 3.2

RAW MATERIALS, PRODUCT STORAGE AND SHIPPING DETAILS

Material	Potential Source	Rout into and out of Plant	Frequency of Import or Export	Size of Shipment	On-site Storage
RAW MATERIAL					
Iron Ore	Pilbara Mines	Railway, conveyer to stockpile	1 train per day	20,000t	4 x 250,000t stockpiles
Limestone	Western Australian sources	Ship and road to stockpile			1 x 7,000t stockpile
Dolomite	Western Australian sources	Ship and road, conveyer to stockpile			Warehouse Bulka Bags
Binders	Yet to be determined	Drums by ship and road to warehouse			
Natural Gas	North West Shelf	Pipeline	Continuous	n/a	none
PRODUCT					
HBI	DR/HBI Plant	Overland conveyer to Port, Ship to customer	3 ships per week	25,000 - 30,000t	50,000t on site
Pellets	Pellet Plant	Conveyers to DRI Plant	n/a	n/a	1 x 100,000t

3.3.1 Iron Ore

Ore trains will be unloaded by a rotary car dumper into a dump hopper. Feeders will discharge the hopper onto a stacking conveyor which will be designed to take consignment samples. The samples will be processed in a sampling plant with the rejects being returned to the stacking conveyor. The stacking conveyor will discharge to a stacker via a tripper system. The stacker will build a chevron layered stockpile and will be capable of travelling the full length of the stockpile.

The ore will be reclaimed by a rotary bucket bridge reclaimer discharging onto a cross conveyor. The cross conveyor discharges to a reclaim yard conveyor which transports the ore to the concentrator. The reclaimer will have the facility to reverse bucket wheel rotation.

This arrangement allows for one stockpile to be built from train shipments and ore to be continuously reclaimed from the second stockpile at feed rate requirements of the concentrator. Separate stockpiles will be established for fine and lump ore.

3.3.2 Limestone and Dolomite

Limestone will be transported to site by truck and unloaded into a dump hopper. From the dump hopper a feeder will load the limestone onto a conveyor and stacker system, which will transport and load it onto a stockpile near the pellet plant. A stockpile capacity of approximately 7,000t is proposed. The limestone handling plant will include a crushing and sizing plant to reduce the limestone as required for the pellet plant. Storage and handling facilities will be designed to contain dust.

Dolomite, if required, will be transported to site by truck in bulk bags and stored in a warehouse.

3.3.3 Organic Binders

Binding materials will be transported to site by truck. They may be in solid or liquid form depending on the source and final process requirements. It is proposed that liquid binding materials be stored in a tank or drums and be pumped to the pelletising process. Solid binding materials may be stored in a storage bin, with pneumatic materials handling for fine materials and mechanical handling for coarse materials. Storage and handling of dry materials will be designed to contain dust.

3.3.4 HBI

The HBI product will be in the form of iron briquettes which are similar in shape to domestic soap cakes. Stockpiling of the HBI will be by means of conventional bulk materials handling systems. It is proposed that the briquettes be transported from the HBI plant to a surge bin at the Port site by an overland conveyor system. The conveyor system will incorporate a stockpile and reclaim facility near the HBI plant and a storage bin at the port. The overland conveyor system is expected to follow the railway line route for most of the distance. The proposed surge bin will have a storage capacity of 1,000 tonnes. A conveyor will transfer the briquettes from the surge bin to the shiploader. The product is in solid form with little risk of dust liberation.

3.4 CONCENTRATOR

3.4.1 Process Description

Iron ore from the stockpile will be discharged into a surge bin from which it will be directed to wet screens. The wet screens will discharge oversized ore to a jig and undersized ore will be pumped to primary cyclones ahead of a spirals plant. The jig will process oversized ore from the wet screens producing a concentrate, a middlings and a waste (tailings) fraction.

The concentrate will be scalped over a screen to produce a concentrate lump as direct feed to the HBI plant, the undersized ore will be directed to a ball mill. The middlings fraction will be ground in a rod mill from which the product will be pumped to the rod mill primary cyclones ahead of a spirals plant. The reject (tailings) will be discharged from the overflow of the jig onto dewatering screens. Oversized tailings will be conveyed to a coarse tailings stockpile. Dewatering screen, undersized ore and water will be recirculated to jig.

The spirals plant will receive feed from the wet screen and rod mill primary cyclones. The overflow will report to desliming cyclones and the underflow will feed the primary spiral banks. Further concentration will be undertaken in additional spirals circuits. The concentrate from the spirals plant will be pumped to a pan filter to reclaim water and the filter cake will discharge to the ball mill. The tailings from the spirals will be directed to a pan filter to reclaim water and the filter cake will discharge to a conveyor which will discharge it to the tailings stockpile.

The Wet High Intensity Magnetic Separation (WHIMS) plant will receive feed from the underflow of the desliming cyclones. The desliming cyclones overflow will be directed to the thickener. The WHIMS concentrate will be pumped to a concentrate thickener from which the underflow will be pumped to the ball mill. The WHIMS tailings will be pumped to a tailings thickener. The underflow from the tailings thickener will be pumped to a tailings dam.

The ball mill will receive concentrate feed from the jig, spirals via a pan filter, WHIMS via a concentrate thickener and degraded pellets from the pellet plant. The product from the ball mill will be pumped to the pellet plant dewatering system via a ground ore thickener.

3.4.2 Environmental Management

Beneficiation is performed wet, so fugitive dust emissions are not an issue. Water consumption is minimised by in-plant recycling. Tailings will be generated and disposed of in a tailings dam (see Section 3.9.1). The tailings disposal areas will be engineered to be environmentally benign and landscaped to be visually non-intrusive.

3.5 PELLET PLANT

3.5.1 Process Description

The shaft furnaces for direct reduction of iron ore require iron oxide feed in the form of lump ore or agglomerated fine ore in order to produce HBI at a practical rate and quality. Fine ore will be used as the major feed for the plant due to its abundance in the Pilbara and due to the premium price which high grade lump ore attracts.

The agglomeration technology proposed for the project is a conventional travelling grate pellet plant which produces spherical pellets of approximately 18mm diameter. This type of equipment is standard worldwide for the production of pellets from ores similar to those found in the Pilbara region.

Ground iron ore in slurry form is received from the concentrator and filtered to remove the excess water, forming a filter cake with approximately 12% moisture. Cellulose based organic binders and metallurgical additives (limestone and/or dolomite) are mixed with the filter cake to ensure the final pellet will meet the chemical, fluxing and strength requirements of the direct reduction furnace and subsequent steelmaking operations.

In the balling section, the feed material is fed onto rotating discs where it is rolled to form uniform sized agglomerates called green balls. The green balls are then placed on a travelling grate and passed through an induration furnace. The furnace consists of four progressively hotter stages in which the green balls are first dried using hot air, then fired under natural gas burners, before being cooled to produce strong agglomerates of the high quality required. The gas flow scheme is arranged to recover all useful heat from the fired pellets and the firing zone offgas.

The cooled pellets are suitable as feed for the direct reduction shaft furnace.

3.5.2 Environmental Management

Energy Minimisation

The travelling grate pelletising technology is a highly energy efficient process. Although relatively large quantities of natural gas are required to fire the pellets, the heat in the fired pellets and the burner offgases are recovered and used in the drying and preheating stages.

Gaseous Emissions

Scrubbers, electrostatic precipitators or conventional fabric bag filters are used in the pellet plant to clean the dusty offgases to within accepted limits (generally less than 100 mg/m^3). Dust plumes emanating from plant stacks are avoided. Use of feed ore in slurry form also eliminates ground ore as a source of fugitive dust emissions, which are characteristic of many pellet plants with dry ore handling facilities. The product pellets are hard and dense, and hence are a clean material to handle, with very low rates of dust generation.

Sulphur dioxide is emitted from the main stack, originating from sulphur in the natural gas and ore. However, the emission rate is relatively low due to the low sulphur contents of the local natural gas and ore supplies. No hydrogen sulphide is emitted from the pellet plant due to the high temperature and oxygen content in the combustion zone.

Solid Wastes

All dusts originating in the pellet plant are captured and recycled back as feed material. Undersized pellets are reground in the ball mill. There are no significant solid residues from the pellet plant.

3.5.3 Alternative Technologies

The main alternatives to the travelling grate pelletising technology are:

- A similar pelletising technology, which uses a rotary kiln to fire the green balls. This is not generally used for haematite ore, is more costly and offers no advantage over the travelling grate.
- Iron Ore Sintering - The product of the sinter plant is not regarded as suitable for shaft furnace feed.
- Use of lump ore, which is costly and in short supply. Lump ore also tends to break down in the shaft furnace more than pellets, resulting in lower HBI plant efficiencies.

3.6 HBI PLANT

The final choice of process technology for the direct reduction shafts has not yet been decided. The two alternatives being considered are the MIDREX and HYL technologies. The environmental assessment of the HBI plant has been undertaken using the worst emissions characteristics of the two technologies.

3.6.1 Process Description

The HBI plant converts iron oxide (ore) pellets and lump ore into metallic iron using reformed natural gas as the fuel source and reductant. The major components of the HBI plant are:

- the shaft furnace, in which the oxides are reduced to metallic iron;
- briquetting machines, where the reduced iron is pressed into briquettes for handling and transport;
- the reformer, which converts natural gas into a reducing gas suitable for use in the shaft furnace; and
- the recuperator, used to recover heat from waste gases to improve the energy efficiency of the HBI process.

These components are supported by ancillary systems for handling iron oxide ore, gas, water and reduced iron. Details of the various processes are provided below.

Shaft Furnace

Direct reduction is carried out continuously in the shaft furnace. Iron oxide pellets and lump ore are fed into the top of the furnace, with hot, reducing gas from the reformer introduced into the lower part of the furnace. The pellets flow downward by gravity and contact the counter-flowing gas. Iron oxide in the pellets is heated, reduced and partially carburised by hydrogen and carbon monoxide in the reformed gas. Hot reduced metallic iron is removed continuously from the bottom of the shaft furnace and fed into the briquetting machines. Offgas leaves the system through the top of the furnace, is scrubbed, cooled and cleaned before being recycled to the process or used as fuel gas in the reformer.

The following chemical reactions take place in the shaft furnace:

$$Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$$

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

$$3Fe + 2CO \rightarrow Fe_3C + CO_2$$

$$3Fe + CH_4 \rightarrow Fe_3C + 2H_2$$

Briquetting

The hot, reduced iron from the shaft furnace is fed into the briquetting machines. These machines consist of pairs of rollers shaped to press the iron pellets into "briquettes" - pillow shaped lumps of product typically 90x50x30mm in dimension. The briquettes are continuously discharged from the machines into a quench tank, cooled and stored outside prior to export.

Reformer

Reducing gas is generated by mixing natural gas with either steam or recycled process offgas in a heated, gas tight furnace containing alloy tubes filled with catalyst. Heat for the reformer comes from combustion of some of the process offgas and/or natural gas with air in the furnace. This flue gas leaves the reformer and is cooled in the recuperator prior to being vented to atmosphere via an induced draft stack. Hot, reformed gas is fed back to the shaft furnace for further reduction of iron oxide.

The following chemical reactions take place in the reformer:

Reformer Side:

$CH_4 + CO_2 \rightarrow 2CO + 2H_2$

$CH_4 + H_2O \rightarrow CO + 3H_2$

Combustion Side:

$2H_2 + O_2 \rightarrow 2H_2O$

$2CO + O_2 \rightarrow 2CO_2$

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Recuperator

The energy efficiency of the process is greatly enhanced by use of a recuperator, or heat recovery system. The heat in the reformer flue gas is recovered and recycled to the reformer by using it to preheat the combustion air used in the reformer burners, and also to reheat the process gas to be reformed and sent on to the shaft furnace. Fuel consumption is thereby reduced, and energy losses in the form of hot gas up the reformer flue stack are also reduced to a practical minimum.

3.6.2 Environmental Management

Energy Minimisation

The process description in Section 3.6.1 provides some details of the energy saving features of the HBI process. In particular, the heat recuperator results in extremely high levels of energy efficiency through recovery of heat in the reformer flue gas. In some cases, heat in the gas can also be used to raise steam for power generation. Gas based direct reduction processes are, in general, highly energy efficient as they are able to produce metallic iron from oxide ores in the solid state, without losing the energy used to melt the iron, which is the case in smelting-type ironmaking processes.

Gaseous Emissions

The shaft furnace process is characterised by low levels of dust emissions, with process offgas being scrubbed effectively to remove particulates immediately on exit from the furnace. Dust collection from the briquetting plant is also effective in capturing particulate matter from the briquetting process. The use of oxide feed in pellet form also helps minimise fugitive dust emissions.

The reformer flue gas is very low in sulphur dioxide which originates from the small amounts of sulphur in the natural gas and the lump ore feed to the shaft furnace. There is little contribution from sulphur in the pellets, as this is largely removed during firing of the pellets in the pellet plant. No hydrogen sulphide is emitted in the reformer flue gas, as combustion of the gases takes place at high temperatures in the presence of excess oxygen.

Carbon dioxide scrubbers may also be employed in the HBI plant process gas streams (depending on the technology selected). These scrubbers also tend to remove hydrogen sulphide that may be present in the process gas (depending on the technology selected). The scrubber product gas will be further processed in a thermal oxidisation unit to convert the hydrogen sulphide to sulphur dioxide, before the oxidised gas is vented to atmosphere. The hydrogen sulphide content in the stack gas is expected to be less than 2.4mg/m^3, or less than half of the National Health and Medical Research Council (NHMRC) emission guidelines.

It is also possible that small amounts of process gas containing hydrogen sulphide can be released from the plant via the pressurised charging and discharging hoppers. These hoppers are normally pressurised, but must be periodically depressurised to allow introduction of fresh feed and removal of product. The process gas is released to atmosphere after wet scrubbing to remove particulates. Hydrogen sulphide emissions from the scrubber stacks are expected to be less than 5mg/m^3 at all times.

Solid Wastes

All dusts originating in the HBI plant are recycled to the briquetting machines, the shaft furnace or as feed to the pellet plant. The HBI process produces no slag, as all reduction takes place in the solid state. No other solid wastes are produced in the HBI plant.

3.6.3 Alternative Technologies

Potential technologies for the production of metallic iron have been limited for this proposal to commercially proven direct reduction processes using natural gas for reduction. Shaft furnaces have been in use for the direct reduction of lump ore and pellets with natural gas for many years with considerable success. However, there are other means of producing metallic iron and the applicability of these technologies to this project are discussed below.

Other Direct Reduction Processes

A number of processes for the direct reduction of fine ore are currently under development. These include the FINMET and Iron Carbide processes. However, at this point in time these technologies are yet to be demonstrated as viable on a commercial scale.

The SL/RN process is a direct reduction kiln technology in which gasified coal is the reductant. This process is yet to be applied as modules with capacities in the order of 1Mtpa, and its requirement for coal as a reductant limits its applicability for this project.

Smelting Processes

The blast furnace is the traditional route for the production of pig iron. However, this process requires either purchase of coke, or local production of coke from specific coal types. The absence of a suitable local coal deposit, the cost of shipping coal or coke to the Pilbara, environmental problems associated with coke making and the high capital costs of the blast furnace makes this route unsuitable for the current proposal.

The Corex process for the production of pig iron is also coal based, and no local coal reserve of suitable quality for the Corex process exists in the Pilbara.

Similarly, the HIsmelt technology is unsuitable as it requires coal for reduction, and has not yet been proven on a commercial scale.

3.7 ATMOSPHERIC EMISSIONS

The atmospheric emissions of concern in relation to this project are sulphur dioxide, oxides of nitrogen, hydrogen sulphide, particulates and carbon dioxide. The emissions of carbon dioxide are addressed in Section 7.6.10 which deals with greenhouse emissions. The following sections present information on the emission characteristics during normal operations and upset conditions.

3.7.1 Normal Operations

The emission characteristics expected under normal operations for each source are presented in Table 3.3.

TABLE 3.3

ATMOSPHERIC EMISSION CHARACTERISTICS NORMAL OPERATIONS

Source	Stack Height (m)	Emission Volume (Am^3/hr)	Emission Temp. (K)	Sulphur Dioxide (kg/hr)	Hydrogen Sulphide (kg/hr)	Oxides of Nitrogen [1] (kg/hr)	Particulate (mg/Nm^3)
PELLET PLANT							
Hood/Windbox Exhaust	65	1,811,250	367	70.00	0.00	70.00	100
Discharge Scrubber	30	126,000	345	0.00	0.00	0.00	100
HBI PLANT							
DR shafts[2] (per unit)	115	153,828	372	18.60	0.23	2.95	50
Screening Station Scrubbers[2] (per unit)	18	71,186	307	0.00	0.00	0.00	50
Depressurising Scrubbers[2] (per unit)	115	30,643	400	0.00	0.105	0.00	50
Reformer Flare	30	0	NA	0.00	0.00	0.00	0
Reformer Flue	12.5	827,357	406	0.05	0.00	219.21	5
POWER STATION[3]							
Gas turbines[4] (per unit)	40	663,000	813	0.01	0.00	11.00	0.00

Notes: 1 Oxides of nitrogen emission expressed as nitrogen dioxide.
2 Total of three units.
3 Power station discussed in Section 3.13.
4 Total of six units.

3.7.2 Upset Conditions

A total of five upset conditions have been identified for the Project as follows:

- **Case 1 - Cold Start of the Reformer**

Natural gas is combusted in the reformer and vented to atmosphere via the reformer flue as per normal operation. The offgas rate rises to the normal operating rate over the 26 hour period. Inert gas is passed through the reformer tubes and vented via the flare. At some point in the heatup, the inert gas (fully combusted natural gas with no excess oxygen) is heated in the process gas heaters via natural gas burners and used to preheat the shaft furnace(s). Emission rates from the process gas heaters rise over the 26 hour period to operational rates. However, there is no significant sulphur dioxide emission as the shaft furnace has no iron ore (no source of sulphur other than natural gas).

- **Case 2 - Short Term Shutdown of 1 Shaft Furnace**

Short term shutdowns of a single module can be caused by failure of components within the single shaft furnace which prevent ongoing operation (e.g. sticking valves in the ore charging system or HBI discharging system). In this instance, the reformer operation continues and the reformed gas that would normally go to the shaft furnace is vented by the flare. There is no emission from the process gas heater stack while the reformed gas is flaring.

- **Case 3 - Short Term Shutdown of 3 Shaft Furnaces**

Short term shutdowns of all three modules can be caused by failure of common systems which prevent ongoing operation. In this instance, the reformer operation continues and the reformed gas that would normally go to the shaft furnace is vented by the flare. If the shutdown is of a longer duration, the reformer will be shut down. There is no emission from the process gas heater stacks while the reformed gas is flaring.

- **Case 4 - Total Power Failure**

This event is unlikely as the plant will be supplied by on-site power generation systems. Multiple units configured in parallel reduce the likelihood of losing the total plant supply. However, in this unlikely event, the plant will automatically shut down and divert all process gas to the flare.

- **Case 5 - Total Gas Failure**

This is not considered probable as the gas supply is very reliable. In any case, the capacity of the pressurised gas within the pipeline is sufficient to enable an orderly shut down of the plant. If the gas supply is lost, one of the gas turbines will switch to diesel fuel.

The emissions data for each of these scenarios are presented in Table 3.4

TABLE 3.4

ATMOSPHERIC EMISSION CHARACTERISTICS FREQUENCY OCCURRENCE AND DURATION UPSET CONDITIONS

Source	Stack Height (m)	Emiss Volume Am^3/hr	Emiss Temp (K)	Sulphur Dioxide (kg/hr)	Hydrogen Sulphide (kg/hr)	Oxides of Nitrogen (kg/hr)[1]	Particulate (mg/m^3)
Case 1 - Reformer Cold Start. Two times per year. Duration of 26 hours per event.							
PELLET PLANT							
Hood/Windbox Exhaust	65	1,811,250	367	70.00	0.00	70.00	100
Discharge Scrubber	30	126,000	345	0.00	0.00	0.00	100
HBI PLANT							
Reformer Flare	30	41,275	313	0.00	0.00	0.00	0
POWER STATION							
Gas turbines[2] (per unit)	40	663,000	813	0.01	0.00	11.00	0.00
Case 2 - Short-Term Shutdown of One Furnace. 15 times per year. Duration of 6 hours per event.							
PELLET PLANT							
Hood/Windbox Exhaust	65	1,811,250	367	70.00	0.00	70.00	100
Discharge Scrubber	30	126,000	345	0.00	0.00	0.00	100

TABLE 3.4
(Continued)

Source	Stack Height (m)	Emiss Volume Am^3/hr	Emiss Temp (K)	Sulphur Dioxide (kg/hr)	Hydrogen Sulphide (kg/hr)	Oxides of Nitrogen (kg/hr)[1]	Particulate (mg/m^3)
HBI PLANT							
DR shafts - 2 units	115	153,828	372	18.60	0.23	2.95	50
Screening Station Scrubbers - 2 units	18	71,186	307	0.00	0.00	0.00	50
Depressurising Scrubbers - two units	115	30,643	400	0.00	0.105	0.00	50
Reformer Flare	30	31,000[3]	NA	0.00	0.00	15.20	0
Reformer Flue	12.5	827,357	406	0.05	0.00	219.21	5
POWER STATION							
Gas turbines[2] (per unit)	40	663,000	813	0.01	0.00	11.00	0.00
Case 3 - Short-Term Shutdown of Three Furnaces. Three events per year. Duration of 12 hours per event.							
PELLET PLANT							
Hood/Windbox Exhaust	65	1,811,250	367	70.00	0.00	70.00	100
Discharge Scrubber	30	126,000	345	0.00	0.00	0.00	100
HBI PLANT							
Reformer Flare	30	94,000[3]	NA	0.00	0.00	45.60	0
Reformer Flue	12.5	827,357	406	0.05	0.00	219.21	5
POWER STATION							
Gas turbines[2] (per unit)	40	663,000	813	0.01	0.00	11.00	0.00
Case 4 - Total Power Failure. One event per year. Duration of Emissions 10 minutes.							
HBI PLANT							
Reformer Flare	30	43,000[3]	NA	56.40	0.00	45.60	0
Case 5 - Total Gas Failure. One event per year. Duration of Emissions 10 minutes.							
HBI PLANT							
Reformer Flare	30	43,000[3]	NA	56.40	0.00	45.60	0
POWER STATION							
Gas turbines[4]	40	663,000	813	55.00	0.00	11.00	0.00

Notes: 1 Oxides of nitrogen emission expressed as nitrogen dioxide.

2 Total of six units.

3 For the purposes of air dispersion modelling, the lower heating value of the gas has been applied to calculate an equivalent buoyancy flux using a method devised by Dr Ken Rayner from the DEP. The volumes listed are m^3/s at STP for the flare emissions.

4 Single diesel fired gas turbine.

3.7.3 Fugitive Dust

The main sources of fugitive dust emissions are presented in Table 3.5 together with measures planned to suppress or contain any fugitive dust emissions.

TABLE 3.5

FUGITIVE EMISSIONS SOURCES AND MANAGEMENT

Dust Source	Management of Fugitive Emissions
RAW MATERIALS AREA	
Ore Car Dumper	Dust extraction system to bag filter or equivalent plus water sprays if necessary.
Ore Stacker	Water sprays
Ore Stockpiles	Water sprays
Ore Reclaimer	Water sprays
Miscellaneous Conveyors	Minimise number of transfer points. Conveyor transfer points enclosed.
CONCENTRATOR	
Minimal dust generation during wet beneficiation.	
Tailings handling and disposal	Tailings in slurry form or wet filter cake to prevent dust generation during handling.
PELLET PLANT	
Concentrate and flux handling	Minimise number of transfer points. Conveyor transfer points enclosed. Bag filters on storage hoppers.
Hood and windbox exhaust	Scrubbers or electrostatic precipitators to reduce particulate emissions to less than 100mg/m^3.
Pellet handling	Minimal dust generation as pellets are hard.
HBI PLANT	
Process offgas	Wet scrubber to remove particulates from offgas. Reformer flue gas dust content less than 100mg/m^3.
Briquette screening	Dust extraction system to bag filter or equivalent plus water sprays if necessary.
Briquette stockpiles	Water sprays during handling.
Briquette handling	Minimise number of transfer points. Conveyor transfer points enclosed.

3.8 NOISE EMISSIONS

Table 3.6 presents a summary of the sound pressure levels associated with various components of the plant which are based on measurements taken in similar plants. However, the actual noise emissions of the proposed plant will depend upon the equipment size and the acoustical cladding used in the installation.

TABLE 3.6

EXPECTED NOISE EMISSIONS FROM THE PROPOSED PLANT

Noise Source	Sound Pressure Level at 1m (dB(A))
PELLET PLANT	
Waste Air Stack	80
Roof Openings	72
Gas Reduction Station	85
Waste Gas Fan	83
Up Draft Drying - Fan	83
Windbox Recu Fan	83
Air - Intake	94
Building Openings	78
HBI PLANT	
Roots Blowers	88
Radial Blowers	88
Control Valves and connected piping	90
Pump at Warm Water Basin	85
Screening Station	77
Ascending Belt Conveyor	80
Briquetting Press	85

Standard noise reduction measures include the implementation of silencers in intake or outlet pipes and the application of insulation layers on the fan housings. Further noise reduction measures, such as the complete housing of equipment, use of noise-reduced gear-boxes or noise protection at chutes, will be implemented if required.

3.9 SOLID AND LIQUID DISCHARGES

3.9.1 Concentrator Tailings

3.9.1.1 General Treatment

The major solid/liquid discharge from the plant will be tailings from the concentrator. The tailings consist of low grade iron ore similar to that found all over the Pilbara. The concentration of ore is performed in fresh water with no chemical additives, so the tailings will not contain any residual process chemicals.

Table 3.7 presents information on the tailings production rates and the expected composition for each size range. Three streams of tailings will be generated:

- two coarse tailings streams (0.1-1mm and 1-6.3mm) generated from the gravity separation concentration processes. These streams will be transported by conveyor and spreader system to the coarse tailings disposal area as filter cake; and
- one fine tailings stream (<0.1mm) generated from the magnetic separation process for final ore concentration. This stream will be thickened to the minimum water content possible before being pumped in slurry form to the fine tailings disposal area.

TABLE 3.7
TAILINGS PRODUCTION, SIZE RANGE AND COMPOSITION

Size Fraction	1-6.3mm	0.1-1mm	<0.1mm
Average tonnes per hour produced	50 - 70	50 - 70	70 - 90
Composition wt%			
Total Fe	40 - 50	40 - 50	40 - 50
Fe_2O_3	65 - 80	65 - 80	65 - 80
SiO_2	10 - 20	5 - 15	5 - 15
Al_2O_3	5 - 10	5 - 10	5 - 10
CaO + MgO	0 - 0.5	0 - 0.5	0 - 0.5

Tailings will be disposed of and stored in two ways depending on whether they are coarse (filter cake) or fine (slurry). Fine tailings will be pumped to a tailings dam for impoundment and water recovery. Construction of this dam will initially be carried out using local borrow material (possibly from the body of the dam itself) to build an embankment to RL28.00. This will provide sufficient storage for 2 years of operation during which time the embankment will be progressively raised to its final level at RL40.00 (after 20 years of operations) using coarse tailings material (subject to suitable geotechnical characteristics). Detailed geotechnical investigations will be undertaken prior to the construction of the tailings dams and the dams will be designed to comply with the requirements of the DOME.

Coarse tailings will be removed by conveyor and spread into a landfill disposal area to the north west of the plant site (see Figure1.2). Landfilling operations will proceed by building up the ground in a series of benches of between 10-15m in height with face slopes of 1 vertical to 2 horizontal or as required for stability following the geotechnical assessment of the material. Coarse tailings for the embankment construction will be taken from the landfill area as required.

3.9.1.2 Coarse Tailings Storm Surge Protection

The coarse tailings storage area will be located relatively close to the coast and its base will be below the 1 in 100 year storm surge level. Therefore, the storage area will have to be designed to protect the tailings from being eroded during these events. The following section presents some preliminary details on the type of protection recommended for the coarse tailings disposal area.

Summary

A starter dyke will be required to allow placement of the coarse tailings without erosion of the tailings by high sea levels and wave action. The outside slope of the dyke will, however, also need to be protected from erosion. Three preliminary designs for the dyke and the associated slope protection works are presented on Figure 3.3 as a function of the water depth and maximum wave height on the outside of the starter dyke which in turn, are partly controlled by the ground level. The final design will depend on the results of more detailed studies.

Sources of Materials

It is envisaged that the dyke will be constructed from soils excavated from within the tailings area. This will minimise disturbance of areas outside the pond area and minimise the cost of construction of the dyke. The rock armour and filter materials required for slope protection will need to be obtained from outside the pond area. Geotechnical and engineering studies will be undertaken to determine technically and economically viable sources of these materials. The filter material may, however, be a synthetic fabric.

Slope Protection Design

As shown on Figure 3.3, the slope protection will comprise the following three layers:

- outer layer of primary rock armour to provide protection against wave action;
- middle layer of secondary armour which will also provide protection against wave action; and

- inner filter layer which will prevent migration of relatively fine material from the dyke through the rock armour.

The dimensions of these layers and the size of rock armour are determined from maximum sea levels and maximum wave conditions associated with a 1 in 100 year storm event.

The preliminary designs of the slope protection shown on Figure 3.3 are based on procedures described by CERC (1977) and the following principal parameters:

- ground elevation at the outside toe of the dyke ranges from +1.0m, above Australian Height Datum (AHD) to higher than +4.2m, AHD;
- a preliminary estimate of the 1 in 100 year total still water level of +4.2m, AHD;
- maximum wave height is 60% of the maximum still water depth;
- outside slope of dyke is 3 horizontal : 1 vertical; and
- rock armour size is based on, "No damage criteria and minor over topping".

The total still water level of +4.2m, AHD comprises the following:

- storm surge of 2.7m comprising:
  - inverted barometer effect 0.7m
  - geostrophic current set 1.0m
  - wave set 1.0m
- tide level of 4.7m above lowest astronomical tide (LAT)(Equal to 1.5m, AHD).

This estimate of total still water level is considered to be accurate to within +/- 0.5m.

The method of estimation of maximum wave height is that suggested by CERC (1977). The maximum wave height may, however, be limited by other factors such as the length of the fetch, shape of the coastline and the direction of travel of the ocean waves. All these factors will be considered in the detailed design. Although the approach taken may result in the use of conservatively large maximum wave heights, it is appropriate for a preliminary design.

The slope of the outside of the dyke of 3H:1V, chosen in this preliminary design, is based on consideration of:

- limiting wave run-up height;
- minimising rock size; and
- stability of the slope.

Reductions in the elevation of the top of the slope protection and the size of the rock armour can be achieved if some damage of the protection is assumed to occur. However, the "No damage criteria" is appropriate for this preliminary design.

3.9.2 Other Liquid Wastes

The plant site will be drained such that rainwater flows into a small dam. Water in this dam may be re-used in the plant. In heavy rainfall, the dam will collect all runoff generated in the first twenty minutes of the storm in order to capture any plant dust or waste in the catchment area. Runoff from subsequent rainfall will spill over the dam wall and flow to lower ground.

Wash down areas for vehicles, mobile equipment and any other areas that are identified as potential sources of oil-contaminated run-off shall be designed to contain the run-off. Such areas will be designed as concrete bunded areas which flow to one or more collection sumps. Contaminated rainfall shall be drained from the sumps via a valve controlled discharge. The valve will normally be closed. When accumulated rainfall is drained from the bunded area it will pass a coalescing plate solids and oil separator to retain any oil or diesel contamination. The separated oil will be collected into 200 litre drums and the effluent directed to a standard absorption pit in compliance with the quality requirements of the relevant regulations.

3.10 PLANT MASS BALANCE

The main mass flows in the proposed DR/HBI plant are illustrated in Figure 3.4.

3.11 WATER SUPPLY AND USE

Total plant water quality and quantity requirements have been considered in developing a water management plan to minimise fresh water consumption. The total plant requirement will be approximately 3.3Mm^{3}pa of fresh water and a plant water balance is shown in Figure 3.5. Water usage in the various plant areas is described below.

3.11.1 HBI Plant

The HBI Plant has two main cooling water circuits:

- a process or "dirty" water system used to quench the briquettes and scrub the process offgas; and
- a machinery or "clean" water system for cooling critical plant equipment (e.g. briquetting machines).

It is proposed to cool these two water systems via heat exchangers with cooled seawater. The seawater is supplied from an evaporative seawater cooling tower, with makeup seawater pumped in from a pumping station adjacent to the shiploader. Blowdown brine, with approximately four times the seawater salt concentration will be returned to the ocean in the shiploader area via a diffuser. This cooling scheme will reduce fresh water consumption from approximately 1.5m^3/t HBI for conventional HBI plants with freshwater evaporative cooling towers to less than 0.5m^3/t HBI for the proposed plant.

Despite the use of seawater cooling, some fresh water losses are inevitable due to evaporation from the briquette quench tank, the water clarifier and general spillage and evaporation. This will tend to concentrate the level of salts in the fresh water, requiring periodic blowdown of the system and fresh water makeup. The blowdown water will be pumped to the concentrator for re-use in the process, which has a lower water quality requirement.

3.11.2 Pellet Plant

The pellet plant water usage falls into two areas:

- machinery water cooling, which will also be a closed circuit system cooled by the seawater cooling tower. No water loss is anticipated from this system; and
- water losses from the pellets themselves, which cannot be avoided. A moisture content of approximately 12% is required in order to successfully form balls from the filter cake. This water is lost to the pellet plant offgas when the pellets are fired.

Water recovered when the concentrate slurry is filtered will be returned to the concentrator.

3.11.3 Concentrator

The concentrator uses water at all stages of the beneficiation process, but uses sophisticated recycling systems to ensure that losses are reduced to the minimum possible. The ground floor of the concentrator will incorporate a collection sump to catch all spillages and return them to the plant water system. Similarly, the concentrator acts as a receiver for all water recycled from the pellet plant and HBI plant in order to reduce the requirement for freshwater makeup to this plant area. Water losses from the concentrator are due to:

- the moisture retained by the coarse ore processed in the concentrator then fed directly to the HBI plant without pelletising;
- the moisture retained by the coarse tailings; and
- the moisture lost with the fine tailings pumped to the tailings dam. These tailings will be thickened as much as possible prior to pumping in order to reduce water loss. Excess water from the fine tailings will be recovered for use in the concentration process and for dust suppression.

3.11.4 Material Handling

A small amount of water is used for dust suppression during materials handling and this is lost to evaporation. This water will be supplied from the concentrator as dust suppression has the lowest water quality requirement in the plant.

3.11.5 Treated Water

The plant will have a small water treatment system to purify scheme water for use in the amenities area and machinery cooling systems.

3.12 ON-SITE FUEL AND CHEMICAL STORAGE

3.12.1 Diesel Fuel

Bulk fuel will be stored on-site primarily for vehicle and machinery usage. It is envisaged that this storage will consist of the following tankage:

- 70kl distillate;
- 35kl distillate;
- 2kl hydraulic oil; and
- 2kl engine oil.

Tankage will be above ground and contained within a concrete bunded area. The vehicle refuelling stand will be concrete and will slope towards a spillage containment sump.

Design of the installation will be carried out in accordance with the relevant regulations and standards applicable to the storage and handling of flammable and combustible liquids.

Diesel fuel will also be stored in a "day tank" at the power station and will have a 5kl capacity to allow operation of one duel fuel gas turbine generator for one day as well as an emergency diesel generator for essential services during power failure.

3.12.2 Pellet Plant Organic Binders

The organic binders will be stored on site in either bulk tanks or drums depending upon the most practical method of supply. Storage and in-plant supply areas will incorporate bunding or other appropriate methods to ensure that any spillage or leakages are contained. These products are not harmful to either personnel or the environment.

3.12.3 Laboratory Chemicals

Only simple chemical procedures concerned with raw materials and product analysis will be performed on site. Procedures consistent with statutory requirements and good laboratory management will be in place to safely store these chemicals.

3.12.4 Water Treatment Chemicals

Water treatment programs have not been finalised for the process plant cooling water systems. However, all chemicals will be stored within bunded compounds or other suitable containment devices to ensure no leakage of the treatment chemicals into the environment.

It is anticipated that the water treatment required for the project will be as follows:

- demineralised water for machinery cooling systems. The scheme water will be treated with anti-scalants, acid, oxygen and caustic depending upon the quality of the fresh water supply; and
- the seawater used for cooling may be treated with antiscalants and biocides.

The plant will also have a package sewage treatment plant designed to service the project. The liquid discharge from this plant will be used for landscape irrigation.

3.12.5 Gases for Sulphur Addition

It is possible that small additions of sulphur, in gaseous form, may be required in the HBI plant to avoid deterioration of critical process equipment. This sulphur may be in the form of dimethyl disulphide (DMDS) gas or equivalent and is expected to be stored in either 55 gallon

drums or a stainless steel tank. This chemical is flammable, producing toxic emissions during combustion. However, providing suitable precautions are taken during the handling and storage of this chemical (as discussed in Section 8.3.3), it should not produce a significant risk to personnel or the neighbouring community.

3.13 INFRASTRUCTURE REQUIREMENTS

3.13.1 Power Generation

The power generation and distribution system will provide for the total plant power requirements for normal and emergency operation. Maximum power demand requirement for the complete plant is anticipated to be 117MW, and will be supplied by gas turbine generators, each with a rating of 20MW at 40°C.

Exhaust emissions are predicted to be very low and are expected to be:

- NO_2 (<50mg/MJ of fuel = 25 ppmV at 15% 0_2); and
- SO_2 (0.29µg/m^3 24 hour max.).

3.13.2 Water

The plant will consume approximately 3.3Mm^{3}pa of fresh water. The supply pipeline will follow the supply corridor shown on Figure 1.2.

The plant will also require approximately 5.4Mm^{3}pa of seawater for the cooling tower, with some 1.4Mm^{3}pa of brine being returned to the ocean. It is proposed to pump the sea water from the port site adjacent to the shiploader and that the supply pipeline follow the route of the HBI overland conveyor to the plant. Brine will return to the port site via the same route and will be pumped into the ocean from the ship loading jetty using a diffuser as close to the ocean end of the jetty as possible to ensure the brine is quickly dispersed with minimal marine impacts.

3.13.3 Natural Gas

The proposed plant will consume approximately 154,000Nm^3 of natural gas per hour. To supply the plant with this gas, a pipeline connecting the plant with the Karratha to Port Hedland natural gas pipeline will be constructed. The proposed route for this pipeline is shown in Figure 1.2. Preliminary calculations indicate that the pipeline diameter will be approximately 250mm.

3.14 ADMINISTRATION AND PLANT SUPPORT FACILITIES

All administration, warehousing and other plant support facilities will be located at the plant site, although some minor facilities may also be located at the port location. The buildings housing these facilities will include:

- Administration Building;
- Central Control Room;
- Warehouse and Laydown Area;
- Maintenance Workshop;
- Canteen and Change Facilities;
- Ambulance Bay and First Aid Post; and
- Security and Training Complex.

Buildings such as the Administration, Central Control Room, First Aid Post, Canteen Facilities, Change Facilities, First Aid Post and the Security and Training Complex will be constructed from brick and concrete with steel sheeting roof. All other buildings will generally be steel frame metal clad enclosures. All buildings will be designed to withstand cyclonic conditions.

3.15 PLANT CONTROL SYSTEM

The control system for the plant and its processes consists of field devices, Programmable Logic Controllers (PLC's) and a supervisory computer/operator interface. All interlocking sequencing, process control and monitoring of the plant will be by the PLC system. The

supervisory computer system will act as the man-machine interface, performing data analysis, process optimisation, and generating management and maintenance reports.

The PLC star network will be interconnected via fibre optic data highways allowing communications between each to a central controller at the Central Control Room (CCR). The supervisory computer will be capable of accepting process variables.

The process control system will allow more consistent plant operation and tend to reduce the incidence of plant upsets. Sophisticated interlocking and "fail-safe" systems will ensure that the plant can be shut down in a safe and orderly manner, with little or no environmental impact under virtually all foreseeable circumstances.

3.16 CAPE LAMBERT SHIPPING FACILITIES

3.16.1 Current Wharf Facilities

The Cape Lambert Services Wharf is a private wharf operated by Robe River and was originally designed for use to bring in rails, sleepers and locomotives which were either in large quantities (and therefore cheaper by sea) or too heavy for the roads (in the nineteen seventies). Neither of these situations now apply. The berthing head is 155 metres with mooring dolphins 27m from each end, giving an overall mooring length of 209m. Wharf decking is 10.7m above low water and designed to H20 loading. The construction is steel piling with wooden deck and fenders designed to accommodate ships of 35,000 dead weight tonnes (dwt).

There is a depth alongside of 10m at low water. The tidal range is from 0.5m up to 5m for spring tides and 1.8m to 3.6m for neap tides. Average tides for 75% of the year are 2m. Under keel clearance (UKC) required by pilots is 1.0m.

Whilst the decking is designed to H20 loading and 110t locomotives have been transported across it, Brambles confirm that the last time this was done was in 1980. It is now around 25 years old and in recent years it has only been used for shipments of manganese ore and scrap. An unofficial assessment by a local engineer, who has used it recently, is that loads no heavier than 40t (including the vehicle) should be put on it. This is confirmed by Conaust who loaded scrap there in 20t skips, 18 months ago, which they felt were the maximum weights the wharf could handle.

3.16.2 Product Shipping

International shipping has standardised to a certain extent on common vessel sizes for dry bulk carriers, and these are the ships most readily available and are the most economic to charter.

Given the draft and size of the wharf, the most suitable type of vessel would be either Handy size or Handymax. These types of vessel are described below.

Handysize

The modern handysize vessels are usually in the 25,000-29,000dwt range with cargo liftings of around 23,000-28,000t. Vessels capable of carrying 30,000t are available, but are less common. There has been a tendency to increase the capacity of this type of vessel in recent years to maximise earnings in what is a buoyant, if temporary, market.

Handymax

These are larger vessels of 39,000-45,000dwt and would only be able to take part cargoes, on the available draft. This would result in a higher cost per tonne of cargo which could be negated by increasing the loading from 30,000t up to the maximum permitted by the amount of water available at the time of loading, to make them more economic. These vessels are currently profitable as a result of the large demand in China for smaller size vessels, which will gradually disappear as the port facilities there are increased to take larger vessels. Again, the newer vessels are tending towards the 45,000dwt rather than the lesser tonnages, to maximise earnings.

Indicative dimensions of details for these vessels are provided in Table 3.8.

TABLE 3.8
SHIPPING VESSEL CHARACTERISTICS

Vessel Type	DWT	Cargo capacity (t)	Length		No. of Hatches	Draft (m)	Beam (m)
			Overall (m)	Hatches (m)			
Handysize	25,996	24,500	160	116.0	4	10.24	25.2
Handysize	29,135	27,600	175	127.0	4	10.12	27.0
Handymax	36,639	35,100	186	147.1	5	11.06	28.4
		30,000				9.51	
Handymax	42,000	40,500	180	142.4	5	11.23	30.5
		30,000				9.10	

If a shiploader is built on the existing wharf, then both types of vessels can load without the necessity to move the vessel along the wharf to access hatches. It is probable that the existing wharf would have to be strengthened to handle the Handymax vessels which are above its original design.

Shipping costs per tonne indicate that the most economic vessel to use would be a modern Handymax loaded to around 40,000t which, with 1m UKC, would require 12m depth of water. This depth requirement would mean either the dredging of a channel and basin alongside the jetty to give this depth, or the ships would be limited to completing cargo loading and sailing when tides permit.

Alternately, using either a 32,000dwt Handysize or part loading a Handymax, shipments of 30,000t could be made, which should not require any dredging as they would only require 10m of water (inc. UKC). This would not be as economic, however savings in dredging costs may offset this.

3.16.3 New Port Facilities

For loading the finished product it will be necessary to have the following facilities located in the Port area:

- a trim storage bin suitable for holding up to 1,000 tonnes of briquettes;
- a ship loader suitable to load 30,000dwt ships;
- ship berthing facilities and services jetty; and
- associated facilities including access roads, offices, amenities, water & power supply, electricity supply, sewerage treatment and disposal plant and security compounds.

Briquette Surge Bin

To trim the vessel a surge bin of 1,000t capacity will be provided. The overland conveyor will discharge into the bin with the bin discharging to a conveyor at its base. The surge bin will be at a suitable RL to allow for high tides and wave action. If required, landfill will be carried out to a maximum general RL of 8.00 with rock armouring along embankments exposed to wave action.

Berthing Facility and Service Jetty

To accommodate ships of 30,000dwt it will be necessary to construct berthing facilities with a depth of approximately 10m at Indian Spring Low Water which is suitable for loading 30,000t capacity vessels including both Handysize and Handymax without requiring dredging of the loading basin.

With maximum draft of 10.24m (Handysize vessel of 27,600t capacity) and an underkeel clearance of 1.0m, the exit channel depth required will be a minimum of 11.24m. Assuming vessels will depart on a high tide (average of 2m) then Indian Spring Low Water depths of

9.24m or greater will be necessary to eliminate the need for dredging. Current indications are that dredging of a channel from the berthing area to deeper water will not be necessary.

To service the berthing facility, a jetty will be constructed from the surge bin to the berthing location if the Robe River facilities are unavailable. The jetty will carry the loadout conveyor, water and power services, and will also provide for vehicular access to the ship. A ship loader will be positioned on the jetty at the location of the berthing facility. Both jetty and berthing facilities will be constructed on steel tube piles with a reinforced concrete deck at RL 12.00m.

Protection of wharf steelwork using cathodic protection is proposed.

3.16.4 Incoming Construction Equipment and Materials

Incoming construction materials, where individual loads do not exceed 20t could be accommodated on the Services wharf, but any loads above that coming by sea would need to be handled either in Fremantle, Port Hedland or Dampier and brought to the site by road.

Any modules or heavy lifts from overseas could be handled across the Dampier Public Wharf and brought to site by road. Modules or lifts of up to 200t can be handled this way without problems while any individual weights above this would be checked with the Main Roads Western Australia before approval to manufacture is given. Lengths of up to 50m, widths up to 8m and heights of 6m can be accommodated. Anything above this would also require approval from the Main Roads.

It is proposed to construct a new access road from the North West Coastal Highway. This road would follow existing tracks in the area where practical (Figure 1.2).

3.17 WORKFORCE

Adequate skilled labour is available in Western Australia to build and operate the Project. A single industry union, working under an agreement that provides for multi-skilling and maximum workforce flexibility, would be sought to operate the Project facilities to enable the achievement of high plant operating factors. Figure 3.6 indicates the estimated production workforce.

3.17.1 Construction Workforce Accommodation

The construction workforce is expected to peak at approximately 1,600 people in 1997. The workforce will be accommodated in a temporary construction camp and existing caravan parks in the region.

The construction camp will be managed in accordance with the requirements of local and state government and will include an approved domestic wastewater management system.

3.17.2 Operational Workforce Accommodation

The operational workforce will be accommodated in existing or new housing located in Karratha, Wickham and Point Samson.

3.18 SUMMARY OF MAJOR INPUTS AND OUTPUTS

The major inputs and outputs of the DR/HBI project are summarised in Table 3.9.

TABLE 3.9
MAJOR INPUTS AND OUTPUTS
PROPOSED DR/HBI PLANT

Component	Input	Output
Iron Ore		
- Fine	4.66Mtpa	
- Lump	1.65Mtpa	
- Fine Tailings		0.52Mtpa
- Coarse Tailings		0.79Mtpa
Natural Gas	6,152GJ/Hr	
Limestone	60,000tpa	
Dolomite	11,000tpa	
HBI		3.6Mtpa
Water		
- Scheme	3.29Mm^3pa	
• Evaporation and Offgases		2.19Mm^3pa
• Dust Suppression		0.09Mm^3pa
• Machine Cooling & Amenities		0.03Mm^3pa
• Tailings Disposal		0.97Mm^3pa
- Ocean	5.38Mm^3pa	
• Evaporation		4.04Mm^3pa
• Ocean Disposal		1.34Mm^3pa

Atmospheric Emissions

Emission Source	Sulphur Dioxide (kg/hr)	Nitrog Dioxide (kg/hr)	Hydrog Sulphide (kg/hr)	Particulate (mg/m^3)	Volume (Nm^3/hr)
Pellet Plant					
• Hood/Windbox Exhaust	70.0	70.0	0.0	100	1,347,333
• Discharge Scrubber	0.0	0.0	0.0	100	99,704
HBI Plant					
• DR Shafts (total)	55.8	5.9	0.7	50	338,670
• Screening Station (total)	0.0	0.0	0.0	50	189,906
• De-Pressuring Scrubbers (total)	0.0	0.0	0.3	50	62,742
• Reformer Flue	0.1	219.2	0.0	5	556,326
Power Station (total)	0.1	66.0	0.0	0	1,596,790

Appendix 5

Proponent's consolidated list of commitments

Proponent's consolidated list of commitments

The proposed DR/HBI Project has been designed to minimise environmental impacts, consumption of fresh water and solid and liquid waste discharges while maximising its energy efficiency. Therefore, the Project represents an excellent opportunity for Western Australia to add value to its resources in an environmentally responsible manner.

The Project will have a number of other significant benefits including:

- increased export earnings for the State;
- further utilisation of the natural gas resource of the region;
- creation of employment opportunities;
- flow-on economic growth of the region;
- establishment of value added resource processing;
- creation and diversification of markets for WA iron ore; and
- better utilisation of existing infrastructure.

The Proponent is very conscious of its environmental responsibilities and is committed to planning, constructing and operating the proposed DR/HBI plant in an environmentally and socially acceptable manner. Environmental management strategies and procedures have been developed to minimise environmental impacts and a number of formal commitments have been made by the Proponent. These commitments will be implemented to the satisfaction of the landowner and/or relevant DMAs and are summarised below.

COMMITMENT 1

Prior to commencement of construction, the Proponent will prepare an Environmental Management Programme in consultation with the EPA and CALM and to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 2

The Proponent will progressively rehabilitate disturbed areas to minimise disturbance of biological communities. The rehabilitation will be undertaken using best industry practice and will be completed to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 3

Prior to the commencement of construction, the Proponent will develop and implement a weed control and vehicle hygiene programme in consultation with CALM, the APB and other relevant DMA's and to the reasonable satisfaction of the Minister for the Environment. This programme will be included in the EMP.

COMMITMENT 4

The Proponent will establish a programme to monitor total dissolved solids, total suspended solids, pH and conductivity in the principal tributary prior to its discharge from the site. This programme will be designed prior to the commencement of construction and will be implemented periodically during the construction and operational phases, to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 5

The Proponent will minimise the off-site transport of sediments through the use of sedimentation ponds, the minimisation of exposed surfaces and identification and treatment of on-site areas with erosion potential. This will be carried out to the reasonable satisfaction of the relevant DMA's and the Minister for the Environment.

COMMITMENT 6

The Proponent will use the best practicable technology during the operation of the Project to ensure that the emissions of oxides of nitrogen from the power station do not exceed 0.07g/m^3 (expressed as NO_2 at 0°C, 101.3kPa, 15% oxygen, dry). This will be undertaken to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 7

The Proponent will minimise the emissions of hydrogen sulphide by:

- monitoring the dosage of di methyl-disulphide to minimise the emissions of hydrogen sulphide from the reformer gas stream; and
- partially incinerate the direct reduction shaft emission of hydrogen sulphide prior to its discharge.

These activities will be undertaken during the operational phase to the reasonable satisfaction of the Minister for the Environment.

In the unlikely event that odours are detected in residential areas and the AUSI Iron Project is identified as the source, the proponent will take reasonable action to isolate the source of the odours within the plant and undertake reasonable remedial action to eliminate the problem.

COMMITMENT 8

The Proponent will implement dust mitigation measures including containment and suppression during the construction of the Project to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 9

The Proponent will minimise dust generation during the operation of the facility by implementing the following measures to the reasonable satisfaction of the Minister for the Environment:

- maintain a landscaped perimeter around the facility;
- use of particulate scrubbing equipment;
- covering of conveyor transfer points;
- regular cleaning of areas likely to accumulate dust;
- sealing of major roadways; and
- use of water sprays on stockpiles.

COMMITMENT 10

The Proponent will conduct periodic monitoring of the major point source emissions for sulphur dioxide, oxides of nitrogen, particulates and hydrogen sulphide. The frequency of such testing will be determined in consultation with the EPA and the monitoring programme will be undertaken to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 11

The total carbon dioxide emission for the Project will be calculated by the Proponent on an annual basis and reported to the EPA. These activities will be carried out to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 12

The Proponent will monitor ambient dust levels in the vicinity of its plant on a quarterly basis. A dust deposition monitoring programme would be established to record the dust deposition on a quarterly basis. In addition, ambient dust concentrations will be monitored in the event that dust complaints relating to the Project occur. The monitoring programme will be conducted to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 13

The Proponent will ensure that noise associated with the construction and operation of the Project will comply with the requirements of the Noise Abatement (Neighbourhood Annoyance) Regulations 1979. If noise levels attributable to the Project exceed EPA criteria, the Proponent will take measures to minimise the impact and achieve the required standards. These measures will be carried out to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 14

Prior to the construction of the tailings dams, the Proponent will undertake geotechnical investigations and will design and operate the dams to meet the reasonable requirements of DOME and the Minister for the Environment.

COMMITMENT 15

The Proponent will complete an assessment of the potential environmental impacts of the port site and the associated infrastructure. The assessment will be undertaken in full consultation with the EPA, CALM and the Department of Transport and to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 16

The Proponent will assess the sensitivity of the receiving environment to the discharge of concentrated seawater (brine) prior to the construction of the facility. These investigations and the final design of the diffuser will be developed in consultation with the EPA and to the reasonable satisfaction of the Minister for the Environment.

If sensitive resources are identified, the Proponent will model the dispersion and dilution characteristics of the discharge plume to predict its impact and design the discharge facility to minimise any impacts on such communities. These activities will also be undertaken prior to the construction of the facility, in consultation with the EPA and to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 17

During the operational phase, the Proponent will discharge the concentrated ocean cooling water using a surface-based diffuser. The discharge system will be designed to minimise any potential environmental impacts. The Proponent will not discharge waters more than 4°C above the ambient ocean temperature. The design and operation of the diffuser will be undertaken in consultation with the EPA and to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 18

Prior to commissioning, the Proponent will undertake a survey of toxic contaminants that may occur in the effluent, particularly organic pollutants (eg. heavy metals), in the marine sediment and suitable biota from the area. Following commissioning, the Proponent will periodically undertake further testing to assess the impact of the project. The frequency of testing will be decided in consultation with the EPA and all sampling results will be supplied to the EPA on an annual basis. These activities will also be undertaken to the reasonable satisfaction of the Minister for the Environment.

In the event that unacceptable levels of contamination are identified and are shown to be attributable to the AUSI Iron Project, AUSI will:

- assist in the investigations to identify the source;
- undertake remedial action on its plant if it is the source of contamination; and
- remediate the impacted area if its plant is the source of contamination.

COMMITMENT 19

The Proponent will undertake periodic testing for the presence of heavy metals and free chlorine and other marine water quality parameters in the vicinity of the ocean intake and discharge streams during the operation of the Project and to the reasonable satisfaction of the Minister for the Environment. The frequency of the testing will be determined in consultation with the EPA and the Proponent will report the results annually unless the monitoring identifies metal levels outside of preset criteria, in which case the results will be reported to the EPA as soon as they are known.

COMMITMENT 20

The Proponent will undertake an ethnographic and archaeological survey of the project area and obtain all approvals required under the *Aboriginal Heritage Act* (1972-1980). This survey will be undertaken prior to the construction of the Project and to the reasonable satisfaction of the Minister for Aboriginal Affairs.

COMMITMENT 21

The Proponent will address Aboriginal heritage issues in the induction programme to increase awareness of Aboriginal culture and will provide training and employment opportunities for Aboriginal people during the construction and operation of the Project.

COMMITMENT 22

The following commitments are made by the Proponent to minimise the risks associated with the operation of the proposed plant:

- hazardous chemicals and fuel storage areas will be bunded and constructed in accordance with AS1940 - 1993;
- the 2,000kPa natural gas distribution system will be placed a minimum of 44m inside the boundary fence of the site;
- systems will be installed (either as procedures or by design) that would ensure shutdown following a release of either hydrogen or natural gas;
- rigorous procedures will be in place to prevent air ingress into vessels containing either natural gas or hydrogen at either plant start-up or shutdown;
- abnormal operating conditions which have the potential to produce high levels of toxic emissions will be identified and procedures put in place to either correct the condition or shutdown the operation; and
- the hot flare will be sited such that there is no potential for off-site thermal radiation effects and at a height sufficient to ensure adequate dispersion of toxic emissions.

These activities will be undertaken to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 23

The following commitments are made by the Proponent in order to minimise the risks associated with construction and operation of the natural gas pipeline:

- construction in accordance with AS2885 - 1987;
- separation distance between the lateral natural gas pipeline and residential properties of approximately 125m. This distance is based on a preliminary estimation of risks and is considered to be very conservative;
- marking of the pipeline route;
- regular patrols of the pipeline (including walking, road and aerial patrols);
- communication with adjacent landowners;
- appropriate corrosion protection and detection (internal and external);
- appropriate depth of cover; and

- slabbing at all road, rail and river crossings.

These activities will be undertaken to the reasonable satisfaction of the Minister for the Environment.

COMMITMENT 24

Prior to commissioning, the Proponent will establish a ground water monitoring programme to record the water quality and depth of the water table at the perimeter of the Plant area and the fine tailings dam. The monitoring programme will be designed to monitor water quality both upstream and downstream of the tailings dam on a quarterly basis. The monitoring programme would be designed and implemented to the reasonable satisfaction of the Minister for the Environment.