Hismelt Iron Ore Smelting Project at Kwinana

Hismelt Corporation Pty Ltd

Report and Recommendations of the Environmental Protection Authority

Environmental Protection Authority
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Contents

Summary and Recommendations

Hismelt Corporation Pty Ltd propose to establish a Research and Development Facility at Kwinana to prove the feasibility of a direct iron ore smelting process capable of producing commercially saleable iron product. The iron would ultimately be used as feed material for the production of steel products. Hismelt Corporation Pty Ltd is a joint venture between CRA Limited and the Midrex Corporation of USA, which has been formed to manage the project.

The research facility will be constructed within the boundaries of the decommissioned Australian Iron and Steel plant (Figure A) under lease arrangements from BHP.

The proposed facility has an estimated capacity of 100,000 tonnes per annum and has been developed from the results of seven years of research at a small scale pilot plant (15,000 tonnes per annum) in West Germany.

The Authority notes that the proposal is for a research project and not a commercial operation. It is expected to operate for a three to four year period during which the proponent will operate the facility on an intermittent basis depending on test results. At the end of this period any new uses of the site will require a separate referral for consideration by the EPA.

The Authority set the level of assessment at Public Environmental Review. The eight-week public review period for the environmental review commenced on the 6 November 1989 and ended on the 3 January 1990. Eight public and government agency submissions were received during this period.

The proponent provided ancillary information to the Authority during the review period. This information is included in the proponent's response to issues raised in the submissions. Further to this, the proponent released some confidential licence and operating information associated with the West German pilot plant to the Authority. The Authority accepted this information in confidence and after inspecting the data considers that the West German pilot plant has successfully operated within its licence conditions. The pilot plant has recently been given approval to continue operations.

The Authority considers that as a consequence of the environmental assessment process which includes public, proponent and EPA interaction the original proposal has been improved. Experience has shown this to be the case for many assessments, and the Authority considers this to be a strength of the environmental impact assessment process as it is practised in Western Australia.

The Authority has considered the Public Environmental Review and based on its own investigations, the proponent's responses to issues raised in submissions and other information provided both by the proponent and in the submissions, concludes that the proposal is environmentally acceptable.

Recommendation 1

The Environmental Protection Authority considers that the final proposal has evolved from a process of interaction between the public, proponent and the Environmental Protection Authority. The proponent's Public Environmental Review identified a number of potential environmental impacts for which management commitments were provided. The intent of management commitments is to ensure that actions are taken to prevent unacceptable environmental impacts from occurring or continuing.

The Authority considers that the following aspects of the proposal had potential to cause environmental impacts:

- **sulphur dioxide and dust emission levels;**
- **gas and dust emissions from the process waste stack and secondary exhaust stacks;**
- **on-site liquid waste treatment and disposal practices;**
- **stockpile and jetty dust discharges;**

- details of sampling sites, times and frequency of reporting to the Environmental Protection Authority;
- baseline data acquisition prior to commissioning the facility;
- testing of the liquid waste disposal system should include pH, turbidity, total dissolved solids, suspended solids and fluoride as a minimum;
- a commitment to modify the environmental management programme if the Environmental Protection Authority considers it necessary; and
- a greenhouse gas audit.

The Environmental Protection Authority further recommends that the monitoring results be available to the public.

1. Introduction

HIsmelt Corporation Pty Ltd (HIsmelt) proposes to construct a Research and Development Facility in Kwinana. The basis of the proposal is to prove the feasibility of a direct iron ore smelting process capable of producing commercially saleable iron product.

The facility will be constructed within the boundaries of the decommissioned Australian Iron and Steel Plant under lease arrangements from BHP Steel International Group (BHP) (Figure 1). The Kwinana region offers a number of advantages for this proposal including the availability of existing services, equipment and machinery from the decommisioned site. The site is surrounded by heavy industry and has the potential of improving the general appearance of the area through a landscaping programme and removal of unwanted plant equipment from the site.

The primary objective of the project is to conduct a research and development programme to demonstrate the commercial viability of the direct smelting process. The research facility is not being developed as a commercial operation. The plant will be small in comparison to other iron ore processing plants with an expected production capacity of 100,000 tonnes of iron product per annum. A commercial plant would need to be capable of producing a minimum of 500,000 tonnes per annum. If successful the facility will undoubtedly be used by the proponent as an international showpiece to help sell the process.

Another objective is to demonstrate the environmental benefits of the HIsmelt process against conventional ironmaking methods. These benefits will arise because the sinter plants and coke ovens, and their associated atmospheric emissions (eg. sulphur dioxide and particulate matter), are not required in the HIsmelt process.

The proponent expects the research programme for the HIsmelt process to take three to four years. Other uses of the facility may be considered at the end of the HIsmelt programme. Such other activities could, amongst other options, lead to an extension of operations on the site at a later date. The proponent will be required to advise the Authority, of its intentions prior to any decisions being made.

A Public Environmental Review (PER) was released for public comment for an eight-week period which began on 6 November 1989 and ended on 3 January 1990. Eight submissions were received in response to this Public Environmental Review. Six were from government and local government agencies, one from the Conservation Council of WA and one from a member of the public (Appendix 4).

2. The proposal

2.1 General description

The development of the HIsmelt process began in the early 1980's. A small scale pilot plant (15,000 tonnes per annum) was built and operated in West Germany. The proposed facility in Kwinana is based upon the results of seven years of research and operation at the West German pilot plant.

The facility is expected to operate for varying periods of time during which research information will be collected and assessed. This information is then used to define the operating parameters for the next operating period.

Due to the research nature of this project the operating parameters of the plant can be expected to alter. This may also involve changes to the plant design. The proponent will be required, through the works approval and licence conditions as set under Part V of the Environmental Protection Act, to advise the Authority of these changes prior to their implementation.

HIsmelt has an agreement with BHP to remove all HIsmelt equipment and modifications not required by BHP at the completion of the project, and to leave the site as near as practicable in the condition it was in when made available to HIsmelt.

2.2 Need for the proposal

Commercially viable iron production operations currently take advantage of the economies of scale associated with large single blast furnace installations with annual iron production capacities of up to three million tonnes per annum. The capital cost of such large installations and the need to provide associated infrastructure can be prohibitive, particularly for developing countries.

Other iron production operations can make use of scrap steel. However, utilising this technology is not always feasible due to the constraints imposed by the geographic availability of raw materials and energy, and the quality of available scrap metal.

The Hismelt process has the potential to change accepted processes in the ironmaking industry and lead to a more efficient steel industry, using less capital intensive plants and a wider range of low cost raw materials (eg. non-coking coals) than is currently the case.

2.3 The process

Raw materials will be stockpiled onsite. Iron ore, coal and limestone will pass through a drying and grinding process before use. A pneumatic conveying system will be used in transferring the ground material to the process area.

The ground limestone and iron ore will then pass through a pre-reduction stage. Iron ore will be reduced and the limestone calcined by hot gases channelled into a circulating fluid bed reactor containing the raw materials.

The ironmaking process will take place in a smelt reduction vessel where reduced iron ore, calcined limestone and coal would be injected into molten iron. A process flow diagram is provided as Figure 1 in Appendix 3.

An air pre-heat system will heat cold air to a temperature in excess of 1000^{o}C. This can be achieved by the use of hot blast stoves, fired by natural gas or recovered clean process off-gases.

The molten iron and slag (impurities removed from the iron ore and coal, combined with lime) will periodically be tapped from the smelt reduction vessel and separated. The iron will be collected and transferred to a de-sulphurising station for treatment. The de-sulphurised iron will provide a higher quality product. The iron would then be transferred to a casting plant and cooled.

An advantage associated with this process is the recovery and recycling of clean process off-gas. In utilising this off-gas for the pre-reduction system and hot air blast system, the proponent expects to achieve significant reductions in energy requirements, consequently conserving natural gas and other fuels.

2.4 Site location and availability of services

The proposed site is bounded by the Kwinana power station to the north; a petroleum refinery to the south-west; and a liquefied petroleum gas plant to the south-east. Cockburn Sound lies to the west (Figure 1).

The discharge of sulphur dioxide and dust by all industries operating in the Kwinana region will be controlled by the Environmental Protection Policy for sulphur dioxide and dust in the Kwinana region (EPP) currently being developed by the EPA. This document was available for public review and comment up to 30 March 1990. The implications of this EPP for industry and the Hismelt proposal is explained in Section 5.2.

The proposed site is owned by BHP and will be leased to Hismelt for the duration of the project. The existing shipping facility would be used to transfer iron ore, other raw materials and finished product. BHP will co-ordinate and operate the import/export activities associated with the facility.

3.2 Operational phase

The proponent has identified a number of waste discharge points (Figure 2) that each require management to prevent an unacceptable environmental impact occurring. The process to be used at the research facility is described in Section 2.3 and Figure 1 in Appendix 3, which contains a flow diagram of the process and its waste discharge points. The following sub-sections, (a) to (e), describe the proponent's intended management methods.

a) Waste gas emissions

In consideration of the potential environmental impacts on the air quality of the Kwinana industrial area the proponent provided an analysis of the likely impact of the project on the Kwinana air shed in the PER.

Computer modelling for sulphur dioxide, carbon monoxide and particulate matter concentrations from the waste gas discharges was provided in the PER.

The model predicted worst case sulphur dioxide emission levels of 42 micrograms per cubic metre for a one hour averaging period which occurred 700 metres from the stack. During normal operations the predicted emission level is less than 5 micrograms per cubic metre for a one hour averaging period.

The maximum predicted emission level for carbon monoxide is 0.03 milligrams per cubic metre for a one hour averaging period; and the particulate matter level is less than 1.2 micrograms per cubic metre per one hour averaging period.

The proponent expects these predicted levels to fall within EPA requirements for emissions within the Kwinana industrial region, and that the assimilative capacity of the Kwinana air shed will not be significantly consumed as a consequence.

The proponent also considers that particulate matter from the blowdown exhaust stack, dust and fume extraction exhaust stack and vent bag filter exhausts, will not significantly affect the air quality in the area.

b) Stock pile control measures

Dust emissions from the stock piles have the potential to cause unacceptable impacts. The proponent intends to control dust emissions from these piles by applying water. If this treatment is not adequate then chemical wetting or stock pile blankets will be employed.

Sediment in the run-off water from the stockpiles will be treated in the same manner as other liquid wastes from the site, as explained below.

c) On-site liquid wastes treatment

All liquid discharges will be collected by an upgraded drainage system (Figure 3) described in Appendix 3 of this report. After passing through the sumps and grease traps the liquid will pass through a clarifier for treatment and into a lined settling pond before recycling, or discharge to Cockburn Sound.

d) Cooling water discharge

The proponent identified three potential impacts associated with the cooling water discharge.

- an estimated increase in temperature of $4^{o}C$ at the discharge point which may have a thermal impact on Cockburn Sound.
- the cooling water discharge could contain residual chlorine and its derivatives; and
- the cooling water would flow over the beach prior to discharge into Cockburn Sound.

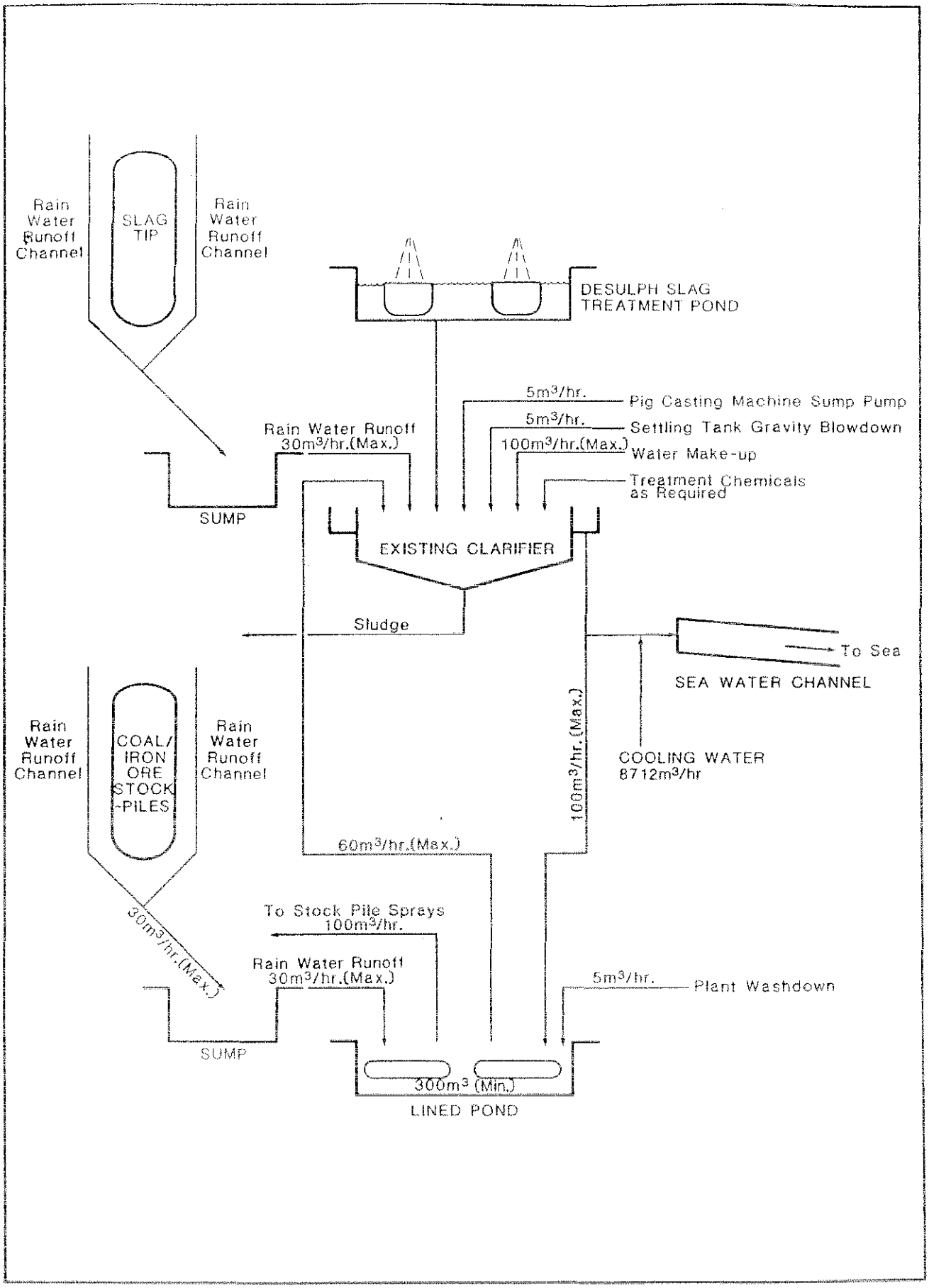


Figure 3: Drainage and wastewater treatment. (Source: Proponent's response to issues raised in the public review period).

and amended commitments made in response to issues raised by the EPA and in the public and government agency submissions.

5. Environmental impacts and their management

5.1 Introduction

The EPA has identified the following aspects of the proposal as those with the greatest potential to cause unacceptable environmental impacts: stack emissions including sulphur dioxide and particulate matter; solid and liquid waste disposal practices; stock pile and jetty dust discharges and the cooling water discharge to Cockburn Sound.

The proposal is sited within an industrial zone and will utilize much of the infrastructure of the existing steel plant. The research facility will be relatively small and it will not load Cockburn Sound with nutrients. Given that other waste discharges will be controlled through an Environmental Management Programme the Authority concludes that the project would not have an unacceptable environmental impact.

The EPA considers that the above issues can be managed by the proponent and that the proposal as described in the Public Environmental Review is acceptable. This is subject to the commitments given by the proponent (Appendix 1), responses to the issues raised during the public submission period (Appendix 3), and the Authority's recommendations in this report.

Recommendation 1

The Environmental Protection Authority considers that the final proposal has evolved from a process of interaction between the public, proponent and the Environmental Protection Authority. The proponent's Public Environmental Review identified a number of potential environmental impacts for which management commitments were provided. The intent of management commitments is to ensure that actions are taken to prevent unacceptable environmental impacts from occurring or continuing.

The Authority considers that the following aspects of the proposal had potential to cause environmental impacts:

- **sulphur dioxide and dust emission levels;**
- **gas and dust emissions from the process waste stack and secondary exhaust stacks;**
- **on-site liquid waste treatment and disposal practices;**
- **stockpile and jetty dust discharges;**
- **stockpile water run-off; and**
- **the cooling water discharged to Cockburn Sound.**

The proponent has made commitments for these issues to prevent or manage environmental impacts. Where appropriate the Authority has made further recommendations in this report.

The Environmental Protection Authority concludes that the proposal is environmentally acceptable subject to it proceeding in a manner consistent with the Public Environmental Review, the commitments made by the proponent in Appendix 1, responses to issues raised in the submissions as detailed in Appendix 3 and the Environmental Protection Authority's recommendations in this Report.

facility commence operations before the EPP becomes law, then an interim approval for operation will be provided.

The Authority considers that given the preceding discussion a recommendation for the control of sulphur dioxide and dust emissions is appropriate. Accordingly the Environmental Protection Authority makes the following recommendation.

Recommendation 2

The Environmental Protection Authority recommends that maximum sulphur dioxide and dust emission levels should be set as a condition of Works Approval and Licence under the Environmental Protection Act (1986) and be consistent with the intent of the draft Environmental Protection Policy for sulphur dioxide and dust in the Kwinana region. When the Environmental Protection Policy has been approved, emission levels will be revised as necessary to conform with the Policy.

5.4 Solid and liquid waste disposal

In response to issues raised in the public submissions and others raised by the EPA, the proponent revised the solid and liquid waste disposal system as described in Figure 2 in Appendix 3, of this report.

A major consideration in assessing the proposal is the satisfactory preparation and implementation of an environmental management programme that will contain more details for the new solid and liquid waste disposal system.

The environmental management programme will also include other requirements which are subject to on-going assessment in order to ensure that the proposed management methods continue to protect the environment eg. monitoring of noise and off-site dust, sulphur dioxide emissions and cooling water discharge. Accordingly the Authority recommends the following:

Recommendation 3

The Environmental Protection Authority recommends that prior to commissioning the research facility, the proponent submits, has approved and subsequently implements an environmental management programme for all waste disposal to the satisfaction of the Environmental Protection Authority.

This programme should include, but not be limited to, the following issues:

- **solid (slag and filter dust), liquid (pond overflow and storm water run-off) and gas emission (waste stack) monitoring, disposal and management methods;**
- **details of sampling sites, times and frequency of reporting to the Environmental Protection Authority;**
- **baseline data acquisition prior to commissioning the facility;**
- **testing of the liquid waste disposal system should include pH, turbidity, total dissolved solids, suspended solids and fluoride as a minimum;**
- **a commitment to modify the environmental management programme if the Environmental Protection Authority considers it necessary; and**
- **a greenhouse gas audit.**

The Environmental Protection Authority further recommends that the monitoring results be available to the public.

"The assimilative capacity is defined as the capacity of the receiving environment to absorb waste without causing long term damage. While the assimilative capacity provides an upper limit to permissible levels of waste discharge, the Authority believes that any unnecessary consumption of the assimilative capacity is undesirable and that polluters would be expected to use all reasonable and practicable means to minimise waste discharge to the environment."

Environmental protection policies, and the concepts of assimilative capacity and beneficial use can each be effective management methods, but in combination they act in a synergistic manner. This approach demonstrates the importance that the Authority has placed on protecting the Kwinana region. Accordingly, any new development in the area would need to achieve a high standard of environmental control.

Commitments

Commitments made by proponents are a means of assuring the Authority that proponents have considered all of the environmental issues associated with their proposal and are willing to accept responsibility for the management of any potential environmental impacts caused by their proposal. The Authority's preferred format for commitments is explained below.

Where an environmental impact identified by the proponent has the potential to occur, the proponent should address this potential impact with a commitment to rectify it or manage it. Where appropriate, the commitment should include:

- **who will do the work;**
- **what is the nature of the work;**
- **when the work will be carried out;**
- **if appropriate where the work will be carried out; and**
- **to whose satisfaction the work will be carried out.**

The form and substance of appropriate commitments can be seen in recent EPA assessment reports eg. Bulletins 410 and 417.

Commitments should desirably be individually numbered and collated into a section of their own in the document to facilitate their transfer into Ministerial conditions which are legally enforceable.

Commitments alone are not sufficient to gain environmental approval. Proponents must demonstrate in their environmental documentation that they have fully considered all potential environmental impacts of their proposal and will prepare and implement an acceptable environmental management programme.

Where possible commitments should be structured so that they can be closely monitored by the proponent and readily audited by a nominated agency, normally the Environmental Protection Authority. By the proponent monitoring its own commitments, agencies such as the EPA can make better use of their limited resources. The auditing function will be undertaken by an appropriate government agency or by EPA.

Requiring commitments to be auditable is necessary to ensure that the management and monitoring requirements of the commitments are being properly performed. The responsible body for the auditing function also needs the powers to be able to ensure any changes it considers necessary are implemented. It is for this reason that commitments should be made "to the satisfaction of" the EPA or a government agency with responsibility for management of the relevant aspect of the environment.

Alternatively the proponent may propose a quantifiable value in a commitment to ensure that there will be no unacceptable environmental impact. The Authority will consider that commitment based on its view regarding the acceptability of the proposed value. For example:

Appendix 1

Consolidated list of commitments made by the proponent

MAJOR RESEARCH AND DEVELOPMENT FACILITY

LIST OF CONSOLIDATED COMMITMENTS

The following is a consolidated list of commitments which have been made by the Proponent to manage any potential environmental impacts associated with the Major Research and Development Facility at Kwinana.

Commitments 1 to 4 and 7 to 12 are as originally stated in the Public Environmental Review. Commitments 5 and 6 have been modified in response to public review comments. These commitments are presented below:

- Commitment 1

  The Proponent commits to preparing and subsequently implementing an Environmental Management and Monitoring Programme prior to construction of the Major Research and Development Facility at Kwinana, that will include:

  - details of parameters to be monitored;
  - an initial baseline sampling period;
  - sampling sites and times;
  - reporting arrangements to the Environmental Protection Authority; and
  - a commitment to modify the management programme, if necessary, to reduce the impact of pollution.

  All of the above will be determined in consultation with the Environmental Protection Authority and other relevant government authorities.

- Commitment 2

  Continuously during the operation of the Major Research and Development Facility at Kwinana, the Proponent will undertake real-time monitoring of stack emissions for sulphur dioxide and total suspended particulates. Should the emission monitoring programme indicate that the Major Research and Development Facility is exceeding acceptable air quality criteria for any emission, then the Proponent will undertake to review and reduce these emissions.

- Commitment 3

  Should dust from the Major Research and Development Facility exceed acceptable air quality criteria in areas beyond the plant boundary, then the Proponent will undertake to review and reduce dust emissions.

- Commitment 4

  The Proponent will co-operate with the Environmental Protection Authority to assist in achieving the air quality objectives that the Proponent understands will be incorporated in the Environmental Protection Policy for the Kwinana region.

- Commitment 5

  During each chlorine dosing period throughout the operation of the Major Research and Development Facility, the Proponent will collect and analyse seawater samples near the cooling water discharge beach outfall for residual chlorine. Should the monitoring programme indicate that the total residual chlorine levels exceed acceptable water quality criterion (2ug/L per six month average and 10ug/L for any single reading) beyond the reasonable zone of influence of the beach outfall, then the Proponent will undertake to review and reduce the residual chlorine levels.

In response to comments received during the public review period, the Proponent has made the following additional commitments :

- Commitment 13
  The Proponent will consult with the relevant authorities including the Town of Kwinana to determine appropriate approvals/procedures for any extension of activities beyond the scope of examining the feasibility of the Hismelt direct iron ore smelting process.

- Commitment 14
  The Proponent will ensure that the Hismelt plant is operated as per the Department of Mines regulations.

- Commitment 15
  The Proponent will take the following actions to improve the aesthetic appeal of the Hismelt lease area:

  - design and build new buildings to current industrial standards; and
  - implement a landscaping programme in consultation with the owner of the site (BHP) and the Town of Kwinana.

- Commitment 16
  The Proponent is conducting an environmental audit which is scheduled for completion prior to the commencement of site works. The audit will establish the baseline groundwater quality of the site. Monitoring bores are being established which will enable ongoing monitoring of groundwater quality (see Commitment 17).

- Commitment 17
  The Proponent will undertake a monitoring and management programme for solid waste disposal. This will incorporate an appropriate drainage and wastewater treatment system to manage potentially contaminated leachates from raw material stockpile or solid waste disposal areas.

  Groundwater quality downstream of these areas will be sampled at regular intervals. The drainage and wastewater treatment system will also be inspected regularly and properly maintained.

- Commitment 18
  The Proponent will implement a water resources management plan to ensure that the consumption of water is minimised.

Appendix 2

Questions to the proponent raised in the public and government agency submissions

General issues

1. In the event the proponent expands the operation or alters it for other purposes at the end of the projected life of the Hismelt proposal, (ie. 3 to 4 years) what action will the proponent take to ensure the public is advised of its plans before any changes are made?

2. The proposed plant will be defined as a minesite and subject to the Department of Mines Regulations. Will the proponent commit to ensuring the plant is operated as per the Department of Mines Regulations?

3. Have investigations of the site been conducted to determine if there is any contamination from previous operations? If not will the proponent commit to an investigation before any site works commence and to an assessment of any associated environmental impact if contamination is present?

4. Did the proponent consider other sites for the Hismelt plant? If so where were they, and why were they ruled out?

5. Submissions asked that the proponent more fully explain the Hismelt process to include more detailed process diagrams showing inputs, outputs and waste streams.

6. The proponent should supply information about the performance of the West German pilot plant to support this proposal.

7. What gas, liquid and solid discharges were monitored at the West German pilot plant? What tests were carried out on these discharges and what were the results? If results were generated, did the government authorities in Germany review them and if so, what were their comments?

8. Will there be any unacceptable odours from the operation of the plant? (eg. from the burning of coal at high temperatures)

9. Does sub-contracting of the port operations by the proponent to BHP, mean that the proponent cannot be held responsible for any dust generated at the port from the loading or unloading of ships carrying raw materials for the plant? If so has BHP indicated to the Environmental Protection Authority that it will be responsible for such activity?

10. Is the proponent confident that the project will not cause any unacceptable environmental impacts or are they unsure of the process?

11. If the proponent is confident that it will not cause any unacceptable environmental impact, why can't it make legally binding commitments to cover each potential environmental impact?

12. Why has the proponent not written its commitments in the format provided by the Environmental Protection Authority as detailed in the guidelines included in the Public Environmental Review?

Management issues

13. Will the proponent release the results of the proposed Environmental Management programme to the public?

14. Will contingency response plans be included in the Environmental Management Programme to ensure that corrective actions can be taken as soon as possible in the event of a plant failure or complaints about operations?

15. Will the proponent commit to prepare and implement a landscaping plan for the site to the satisfaction of the Town of Kwinana?

16. What actions will the proponent take to improve the aesthetic appeal of the site for commuters, the workforce and people using Cockburn Sound?

17. Will the Environmental Management Programme cover the solid waste disposal sites?

Solid waste issues

34. Will the solid waste (ie. molten slag), generated by the plant be contaminated with metals associated with conventional blast furnace slags such as manganese, chromium, cadmium and lead? If not why not?

35. The PER indicates that the solid waste for disposal at the dumps will have no adverse environmental impacts. Isn't the solid waste susceptible to weathering and breakdown with the resultant release of metals to the environment?

36. Mass balance calculations based on data from the Public Environmental Review indicate that more than 90 percent of the added fluoride is not accounted for as either waste or product. Can the proponent account for the rest of the fluoride and explain its associated potential environmental impacts?

37. Does BHP have approval to use its site for solid waste disposal? If so does BHP or the proponent have a management programme to ensure that they are not contaminating the Cockburn Sound environment?

Water resource issues

38. Will the proponent commit to a water resources management plan to address the potential for recycling; water treatment to improve recycling; and the use of groundwater and its impact on the groundwater quality (eg. salt water intrusion) and the Cockburn Sound environment?

Safety issues

39. Will the Employee Safety and Emergency Response Plan include specific contributions by Hismelt to the development of the Kwinana Integrated Emergency Management System?

40. Will the proponent accept the advice of the Fremantle Harbour Master on the screening/re-siting of lights to reduce the possible effect of area lighting on navigation in the Sound?

Appendix 3

The proponent's response to issues raised in the public review period

DAMES & MOORE

3 April 1990

Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attention: Mr S Watson

Dear Sir

RESPONSE TO SUBMISSIONS
MAJOR RESEARCH AND DEVELOPMENT FACILITY
FOR
DIRECT IRON ORE SMELTING
AT KWINANA

Enclosed please find a copy of the document entitled "Response to Submissions, Major Research and Development Facility for Direct Iron Ore Smelting at Kwinana".

The document comprises replies to questions resulting from public review of a Public Environmental Review (PER), over the period from 6 November 1989 to 3 January 1990. A report entitled "Dissipation of the Hismelt Cooling Water Discharge at Kwinana, Western Australia" by Dr C J Hearn of the University of New South Wales, is forwarded separately to this document.

Please do not hesitate to contact us should you require further information.

Yours faithfully
DAMES & MOORE

D. R. Blatchford

D R Blatchford
Associate

CAE:dal/19099-001-071

RESPONSE TO SUBMISSIONS
MAJOR RESEARCH AND DEVELOPMENT FACILITY
FOR
DIRECT IRON ORE SMELTING AT KWINANA

1.0 INTRODUCTION

Hismelt Corporation Pty Ltd (Hismelt) proposes to establish a Major Research and Development Facility on a site within the Kwinana industrial region, 40km south of Perth. In November 1989, Hismelt made available for public review a Public Environmental Review for this project in accordance with the provisions of the Environmental Protection Act (1986).

The Public Environmental Review was subject to an eight week public review period, from 6 November 1989 to 3 January 1990. Eight submissions in total were received, including both government agency and general public submissions, and a summary of these submissions was forwarded to the proponent.

This document responds to forty questions raised in the public submissions, covering a wide range of issues including monitoring and management, gas emissions, liquid waste, cooling water, solid waste, water resources and safety.

2.0 PROPONENT'S RESPONSE TO QUESTIONS

2.1 GENERAL ISSUES

Question 1: **In the event the proponent expands the operation or alters it for other purposes at the end of the projected life of the Hismelt proposal, (ie. 3 to 4 years) what action will the proponent take to ensure the public is advised of its plans before any changes are made?**

Reply: The Hismelt Corporation is seeking approval to examine the feasibility of the Hismelt direct iron ore smelting process. The proponent will consult with the relevant authorities including the Town of Kwinana to determine appropriate approvals/procedures for any extension of activities beyond the scope of this task.

Question 2: **The proposed plant will be defined as a mine site and subject to the Department of Mines regulations. Will the proponent commit to ensuring the plant is operated as per the Department of Mines regulations?**

Reply: Yes. The Hismelt plant will be operated as per the Department of Mines regulations.

Question 3: **Have investigations of the site been conducted to determine if there is any contamination from previous operations. If not will the proponent commit to an investigation before any site works commence and to an assessment of any associated environmental impact if contamination is present?**

Question 7: **What gas, liquid and solid discharges were monitored at the West German pilot plant? What tests were carried out on these discharges and what were the results? If results were generated, did the government authorities in Germany review them and if so, what were their comments?**

Reply: The pilot plant in Germany operates under the Federal Emission Protection Act of the Federal Republic of Germany, the Landratsamt, Amberg-Sulzbach, Postfach 1754, 8450 Amberg. Emissions from the pilot plant conform to the strict guidelines required under German law. Liquid metal is returned to the Maxhutte Steelworks and slag is disposed of in conjunction with Maxhutte blast furnace slags. There are no fluorochloro hydrocarbons or fluorides emitted from the pilot plant.

The operating licence for the pilot plant was renewed in June 1989 through until the end of 1990.

Question 8: **Will there be any unacceptable odours from the operation of the plant? (eg. from the burning of coal at high temperatures)**

Reply: No, there will be no unacceptable odours from the burning of coal. Coal combustion and reaction within the HIsmelt process is completed at very high temperature. Combustion of coal is complete within the process to CO, CO_2, H_2 and H_2O. Odorous organic compounds are not formed.

Question 9: **Does sub-contracting of the port operations by the proponent to BHP mean that the proponent cannot be held responsible for any dust generated at the port from the loading or unloading of ships carrying raw materials for the plant? If so, has BHP indicated to the Environmental Protection Authority that it will be responsible for such activity?**

Reply: BHP will, by contract, be responsible for the environmental aspects of raw material unloading.

BHP are the owners and operators of the raw material unloading system. HIsmelt will be contracting with BHP to discharge raw materials from ship and deliver such materials to stockpiles using existing equipment. As indicated in section 4.8 on page 26 of the Public Environmental Review, dust generation at the unloading facility will be controlled as required by applying water from the existing reticulation system.

Question 10: **Is the proponent confident that the project will not cause any unacceptable environmental impacts or are they unsure of the process?**

Reply: The proponent has the utmost confidence that the project will not cause any unacceptable environmental impact. This confidence is based on seven years of research and development on the HIsmelt process.

Reply: The Environmental Monitoring and Management programme will incorporate a number of features to ensure that appropriate corrective action is taken in response to emergency situations or environmental impacts:

- o key process parameters will be monitored continuously in real time;
- o the plant will be designed to appropriate standards; and
- o trained workers will be on site at all times.

Environmental Contingency Response Plans
Hismelt will include the following contingency response plans in the Environmental Management and Monitoring programme (as detailed in Commitments 2, 3 and 8 of the Public Environmental Review):

- o the proponent will respond to complaints about air, noise and dust as soon as possible and undertake to review and reduce emissions in the unlikely event the facility exceeds acceptable quality criteria.

Emergency Contingency Response Plans

As detailed in the Public Environmental Review (page 59), the proponent will include the following Emergency Response Plans:

- o prior to start-up of the Major Research and Development Facility, the proponent will develop an Employee Safety and Emergency Response Plan for the Major Research and Development Facility as part of its operations manual.
- o the proponent will participate in and contribute to the development of the Kwinana Integrated Emergency Management System.

Question 15: **Will the proponent commit to prepare and implement a landscaping plan for the site to the satisfaction of the Town of Kwinana?**

Reply: As discussed on page 37 of the Public Environmental Review, Hismelt has committed to implement landscaping on the Hismelt lease area. Landscaping will be discussed with the owner of the land, BHP, and with the Town of Kwinana.

Question 16: **What actions will the proponent take to improve the aesthetic appeal of the site for commuters, the workforce and people using Cockburn Sound?**

Reply: As discussed in the Public Environmental Review (section 7.6 page 50), the proponent will take the following actions to improve the aesthetic appeal of the site:

- o design and build new buildings to current industrial standards, incorporating appropriate cladding; and
- o implement a landscaping programme.

In addition, some of the old facilities on the lease will be demolished.

Question 21: **What are the failure modes leading to a major loss of confinement in the off-gas system and are there any off-site implications from such a loss of confinement?**

Reply: During normal operations, the off-gas system is maintained under pressure to prevent air from leaking in to form a combustible mixture. During start-up and shut-down, nitrogen gas purging of the off-gas system will be carried out to prevent a combustible mixture being formed.

Two failure modes which might lead to a major loss of confinement in the off-gas system have been discussed in section 5.2.3 of the Public Environmental Review. These are :

- o over-pressurisation of the smelt reduction furnace, and
- o excessive wearing of the refractory lining of the pre-reduction cyclones.

The former would be prevented by installation and regular maintenance of a pressure relief and gas handling system. The latter would be prevented by regular monitoring of the extent of wearing.

Off-gas leakage from the flanges and rotary valves of the pre-reduction system and the off-gas handling system would have the potential to cause injury to plant personnel through asphyxiation or fire/explosion, however these would be local events and would have no off-site implications.

A number of design features and precautionary measures would be implemented to minimise the risk of injury to plant personnel, as follows:

- o carbon dioxide monitors would be deployed to detect leaks;
- o breathing apparatus would be available;
- o access would be restricted from these areas; and
- o fire/explosion proof electrical equipment would be employed in these areas.

Failure of the off-gas duct work is unlikely because of the robust construction, which includes refractory lining. If failure did occur, the release of hot gas might cause a flare at the point of rupture. Since the excess pressure in the off-gas system will be only 2 bar.g, this flare would be small. Personnel would have ready access to safety equipment, as described in section 5.2.3 of the Public Environmental Review. Operations would be shut-down or modified to allow repairs to be made. There would be no off-site implications except for a very minor and brief additional load of dust and carbon dioxide.

Reply: Quantities of sulphur dioxide and carbon monoxide expected to be emitted over a three year period are given in Table 1 of the Public Environmental Review. Quantities of carbon dioxide that can be expected to be emitted from the plant are as follows:

	HOURLY RATE	ANNUALISED CAPACITY 1991 (1250hr)	1992 (3375hr)	1993 (5000hr)
Carbon Dioxide (t):	50	64,000	175,000	240,000

The term 'annualised capacity' reflects the research and development nature of the Major Research and Development Facility. Hours of operation of the facility would increase from 1250hr initially, up to 5000hr at full scale.

The Western Australian production of carbon dioxide due to use of fossil fuels has been estimated to be 23 million tonnes per annum, of which the manufacturing industries contribute 5.2 million tonnes per annum (adapted from : "Addressing The Greenhouse Effect", W.A. Greenhouse Co-ordination Council, 1989).

The HIsmelt maximum annualised carbon dioxide emissions of 240,000 tonnes per annum would be approximately 1 percent of the state's total carbon dioxide production.

Trace amounts of nitric oxide and nitrogen dioxide (NOx) may be found in the gaseous emissions although these gases do not persist long in the atmosphere and hence do not contribute to the Greenhouse Effect. Nitrous oxide (N_2O) is considered to be a Greenhouse gas, but is not a product of combustion and would not be present in the HIsmelt emissions.

Question 25: **Given the release of the Environmental Protection Policy for the Kwinana region for sulphur dioxide and particulate matter, why does the proponent not intend to use scrubbers to reduce the sulphur emissions?**

Reply: The use of scrubbers to reduce the emissions of sulphur dioxide has not been planned because the predicted sulphur dioxide groundlevel concentrations resulting from the proposed plant are well below the Environmental Protection Authority draft guidelines and well below internationally accepted levels.

As indicated in the response to question 19, the proponent has given a commitment to co-operate with the Environmental Protection Authority to assist in achieving the objectives of the Environmental Protection Policy (Commitment 4).

The quantity of heat discharged by Hismelt will be moderate compared to other discharges in the region. For example, discharges from the BP refinery and the Kwinana power station, compared to that from Hismelt, are:

	VOLUME OF DISCHARGE (m^3/sec)	DEGREES ABOVE AMBIENT (^oC)	HEAT (MJ/sec)
Hismelt	2.4	4	40
BP Refinery	3.6	10	150
SECWA/Kwinana	39	7	280

The cumulative environmental impacts of chlorine will be nil since chlorine itself does not accumulate but is instead quickly destroyed, either by reaction with organic matter in the water or by photolysis to chloride ion and oxygen.

The reaction of chlorine with organic matter, including the algae and other organisms growing on heat exchanger surfaces, will produce some organo-chlorine compounds. Most of the chlorine which reacts with algal cells will form chloramine-type compounds by reaction with amino groups or the nitrogen in DNA or RNA bases. These compounds decay to form chloride ion, and other simple substances such as carbon dioxide, ammonia and chlorine-free organic compounds. Reaction of chlorine with lysed cell material is likely to result in formation of traces of trihalomethane compounds, probably bromoform and bromochloromethanes because of the high bromide content of seawater. While these compounds, and chloroform, are suspected human carcinogens in chlorinated drinking water, they do not accumulate in aquatic organisms and so present no health or environmental hazard in seawater. Some of these compounds will be destroyed by microbial action in the seawater and the remainder will volatilise from the water to the atmosphere.

Question 28: Is the commitment to maintain the cooling water discharge level for total residual chlorine realistic? Past experience indicates that a residual level of 200-500 micrograms per litre must be maintained at the outlet of heat exchangers for effective anti-fouling.

Reply: The Public Environmental Review indicates that the levels of total residual chlorine that would occur in the cooling water discharge into Cockburn Sound would be below the most stringent guideline which specifies that no six month average is to exceed 2 micrograms per litre and that no single reading is to exceed 10 micrograms per litre (page 48). The proponent believes that these levels are achievable for the following reasons:

Question 32: Given that stormwater run-off from stockpiles has a potential to contain elevated levels of sulphur, fluoride and be acidic, why doesn't the proponent install a synthetic membrane in the settling pond and provide some pre-treatment of the waste liquid before it reaches the Sound?

Reply: As indicated in the response to Question 30, rainwater runoff from the coal stockpile would be channelled into a sealed settling pond, and either recycled for dust suppression or treated and clarified prior to discharge to the Sound.

Question 33: Does the proponent expect quarterly testing of the cooling water discharged to Cockburn Sound to be sufficient to ensure against unacceptable environmental impacts? On what basis does the proponent justify quarterly sampling; weekly testing would surely be more appropriate.

Reply: Continuous monitoring of the cooling water discharge temperature will be carried out. Chlorine dosing will be intermittent only (about one week in four). Seawater samples will be taken during each chlorine dosing period to determine the chlorine concentrations. The chlorine sampling and monitoring programme will be defined in consultation with the Environmental Protection Authority.

2.5 SOLID WASTE ISSUES

Question 34: Will the solid waste, (ie. molten slag) generated by the plant be contaminated with metals associated with conventional blast furnace slags such as manganese, chromium, cadmium and lead? If not why not?

Reply: Leach tests on related iron bath slags yielded undetectable (by normal methods) levels of heavy metals. Nevertheless, it has been established that the primary slag from the smelt reduction vessel will be basic and therefore slowly leachable. The proposed solid waste disposal and drainage and wastewater treatment system described below and on Figure 2 will ensure minimal environmental impact:

- o primary slag will be stored onsite on a hard pan area that will be underlain by clay.
- o rainwater run-off from the primary slag area will be channelled into the existing clarifier and treated and tested before being directed to the sealed settling pond for reuse in the dust suppression system. Overflow water from the clarifier would be treated and tested prior to discharge into Cockburn Sound.

2.6 WATER RESOURCE ISSUES

Question 38: **Will the proponent commit to a water resources management plan to address the potential for recycling; water treatment to improve recycling; and the use of groundwater and its impact on the groundwater quality (eg. salt water intrusion) and the Cockburn Sound environment?**

Reply: The proponent will implement a water resources management plan to ensure that the consumption of water is minimised.

Rainwater runoff from the coal and iron ore stockpile areas will be recycled and used to suppress dust in the stockpile areas. Rainwater runoff from the primary slag tip will be clarified and treated prior to being recycled in the stockpile dust suppression system.

It has not been decided whether groundwater will be required for use onsite. If it is necessary to use groundwater then this will only be abstracted in accordance with the licence requirements of the Water Authority of Western Australia. The conditions associated with the issuing of such a licence would ensure that there will be no detrimental effect on the underlying aquifer.

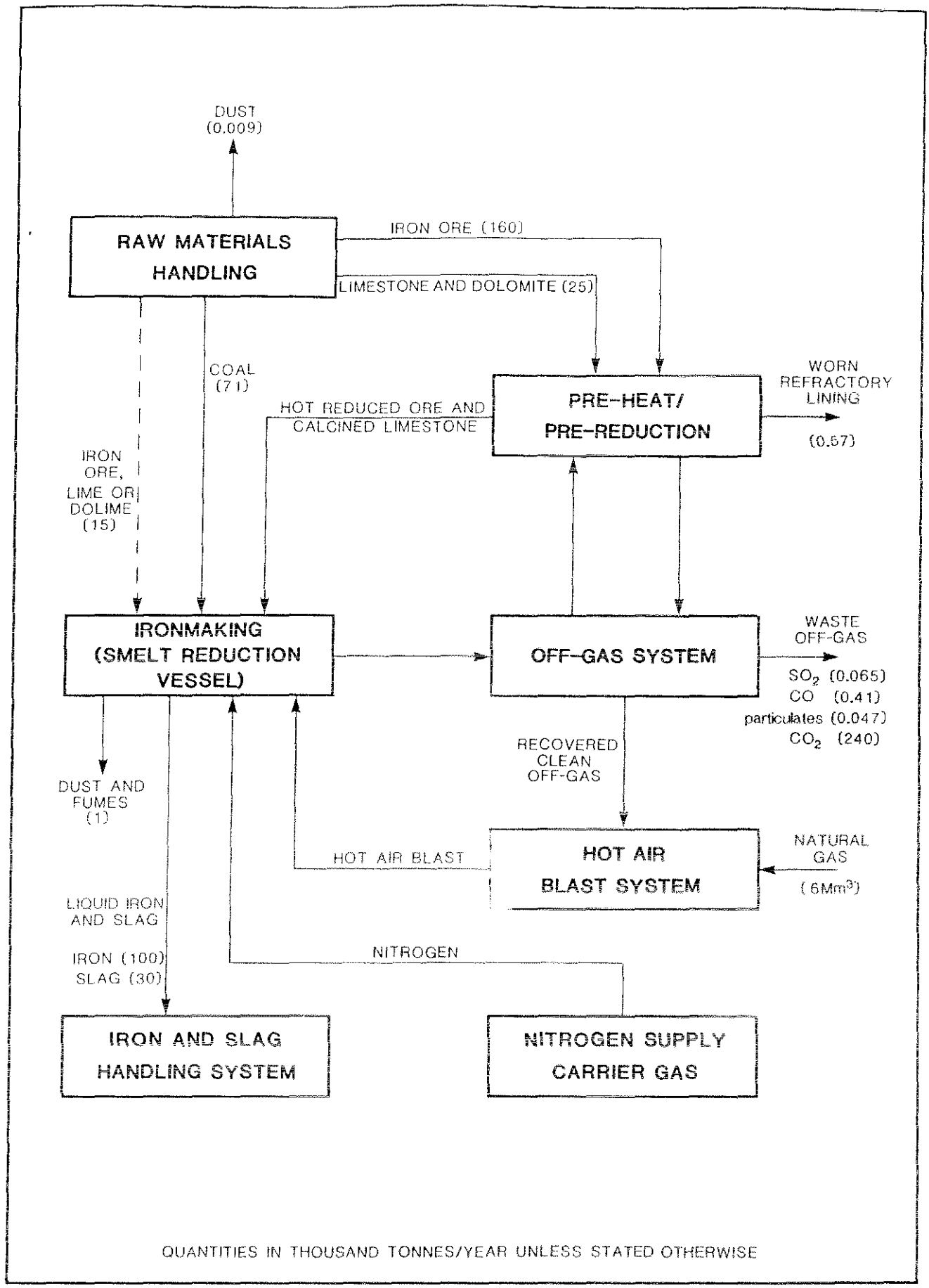
2.7 SAFETY ISSUES

Question 39: **Will the Employee Safety and Emergency Response Plan include specific contributions by Hismelt to the development of the Kwinana Integrated Emergency Management System?**

Reply: Yes. The proponent is prepared to participate in and contribute to the development of the Kwinana Integrated Emergency Management System.

Question 40: **Will the proponent accept the advice of the Fremantle Harbour Master on the screening/re-siting of lights to reduce the possible effect of area lighting on navigation in the Sound?**

Reply: Yes. The proponent is prepared to accept the advice of the Fremantle Harbour Master in relation to lighting which falls within its area.



PROCESS FLOW DIAGRAM
(YEAR 3 and 4)

FIGURE 1
DAMES & MOORE

Appendix 4

List of organisations and individuals who made submissions

Appendix 4

List of organisations and individuals who made submissions

Mines Department of WA

Water Authority of WA

Town of Kwinana

Conservation Council of WA Inc

Local Authorities Environmental Review Committee

Fremantle Port Authority

City of Cockburn

A member of the public