HIsmelt (Operations) Pty Limited

Commercial HIsmelt® Plant
Kwinana Western Australia

Response to Submissions

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RESPONSE TO SUBMISSIONS

COMMERCIAL HISMELT® PLANT
KWINANA WESTERN AUSTRALIA
HISMELT (OPERATIONS) PTY LIMITED

1. INTRODUCTION

HIsmelt (Operations) Pty Limited (the Proponent), acting as the manager on behalf of an unincorporated Joint Venture with the following parties:

- HImet Corporation Pty Ltd (ABN 61 004 920389) a wholly owned subsidiary of Rio Tinto Limited;
- Nucor Australia, LLC, a wholly owned subsidiary of Nucor Corporation (USA);
- M C Iron and Steel Pty Ltd (ABN 66 064 296 243) a wholly owned subsidiary of Mitsubishi Corporation (Japan); and
- China Shougang International Trade and Engineering Corporation, a wholly owned subsidiary of Shougang Corporation (of China),

proposes to construct and operate a commercial HIsmelt® Process Plant (the Plant) at Kwinana in Western Australia. The Plant, the associated facilities and operations are referred to as the Project. The Plant will be located at the site occupied by the existing HIsmelt Research and Development Facility (HRDF) within the Kwinana Industrial Area (KIA), 40km south of Perth.

The Project was referred to the Western Australian Environmental Protection Authority (EPA), who determined that the Project would be assessed as a Public Environmental Review (PER) with a four week public review period.

The Commercial HIsmelt Plant PER (HIsmelt Operations/Corporate Environmental Consultancy, 2002) was available for public review between 22 April 2002 and 20 May 2002. During this period the EPA invited submissions from government agencies and the public to help them prepare an assessment report in which it will make recommendations to Government.

The EPA received 22 submissions on the PER, which included 8 submissions from Government agencies. A copy of each of the submissions was provided to HIsmelt with the identity of the senders kept confidential, with the exception of the Government submissions. The content of the submissions was summarised by the Proponent and provided to the EPA Service Unit for review and comment. A final summary was prepared which included the EPA Service Unit's comments and resubmitted to the EPA Service Unit for verification that it is an accurate summary. The comments and questions from the submissions are presented in italics in Section 4 of this report together with the Proponent's response.
This report is the Proponent's Response to Submissions and this document together with the PER provides the relevant details of the Project and the proposed management techniques to enable the EPA to assess the environmental acceptability of the Project.

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2. REPORT FORMAT

The Response to Submissions has been prepared based on the content of the submissions. As requested by the EPA Service Unit, the document has been structured to respond to the issues raised rather than each individual submission.

The response section has been divided into issues, which are presented together with the relevant comments/questions raised in the submissions related to that particular issue. The Proponent has prepared a response to the comment/question and provided additional information where required. Many of the comments/questions raised on particular issues related to the same area of concern. In those circumstances the questions have been grouped together and a single response has been prepared to avoid duplication of the response. Where the information is already contained in the PER the Proponent has referred to the relevant section of the PER and has only taken small excerpts from the PER, where necessary, to establish the context of the response.

Any modifications to the Project characteristics or the content of the PER are also documented in this report (see Section 3.0).

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3. PROJECT KEY CHARACTERISTICS

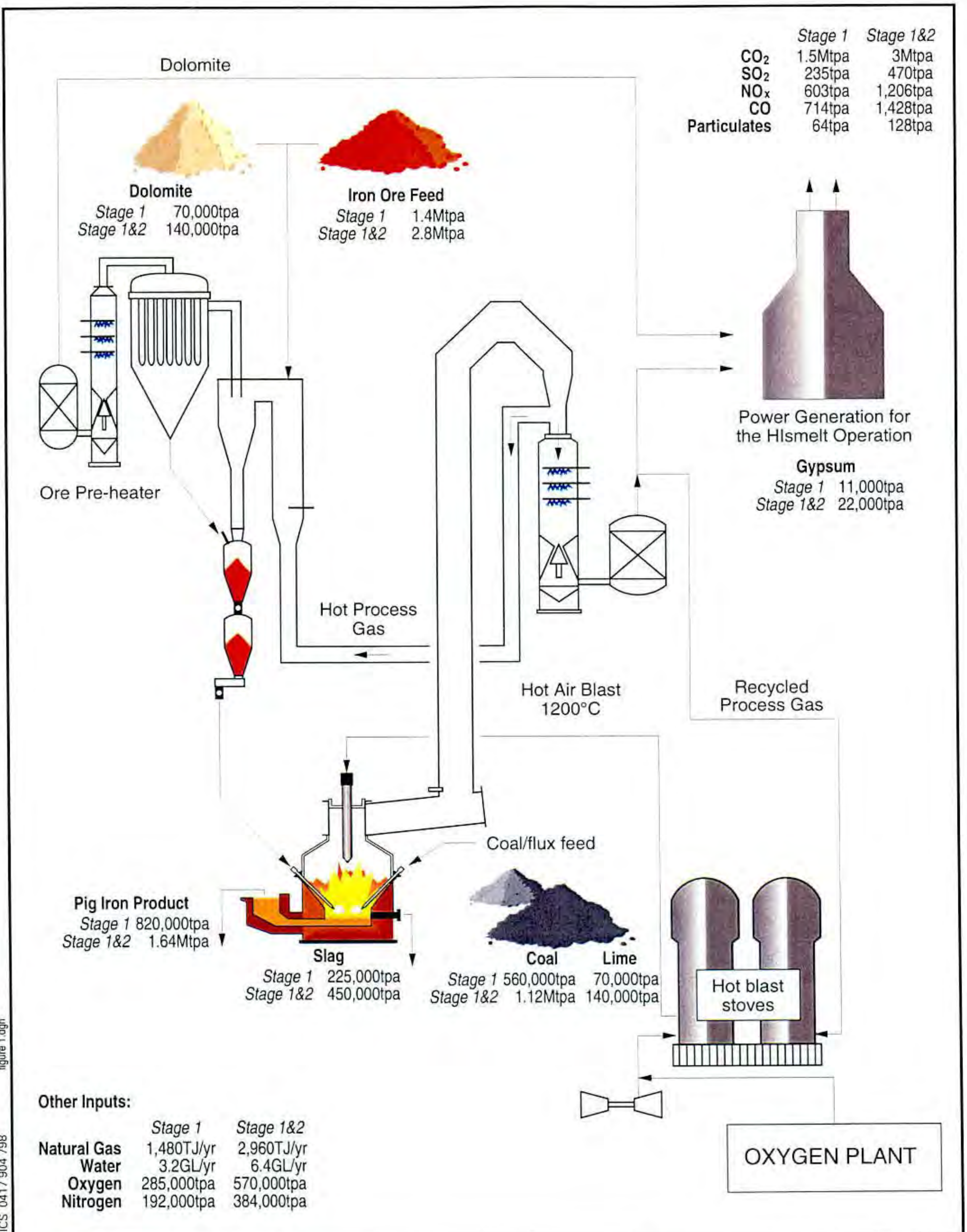
An amended Process Flow Diagram, which details the inputs and outputs of the Project, is provided as Figure 1. The key characteristics of the Project are presented in Table 3.1

Table 3.1
Commercial HIsmelt Plant Key Characteristics
(Estimates at time of preparation of the PER)

ELEMENT	DESCRIPTION	
	Stage 1	**Stages 1 and 2**
Project Purpose	To construct and operate a HIsmelt Process Plant in Kwinana to produce pig iron.	
Project Location	Leath Road, Kwinana Industrial Area, Western Australia.	
Life of Project (yrs)	20+	20+
Project Components	• Process Plants. • Transport of Materials and Product. • Water Supply. • External Electrical Supply. • Natural Gas Supply.	
Plant Components	• Raw Material Delivery and Storage. • Raw Material Reclamation and Preparation. • Ore Preheater. • Smelt Reduction Vessel. • Offgas System. • Flue Gas Desulphurisation System. • Pig Iron and Slag Production. • Power Generation Facility. • Air Separation Unit (Oxygen and Nitrogen Plant). • Water Supply Facilities and Circuits. • Effluent Treatment Facility. • Stormwater and Wastewater Collection Facilities. • Electrical Power Supply Facilities. • Natural Gas Supply Facilities. • Administration Facilities. • Plant Access Roads and Car Parking.	
Plant Operating Hours (per day)	24	
Operating Hours (per year)	7660 – 8760	
Pig Iron Production (ktpa)	820	1640
Slag Production (ktpa)	225	450
Gypsum Production (ktpa)	11.1	22.2
Iron Ore Fines (ktpa, by ship)	650	1300
Iron Ore Fines (ktpa, by Rail)	650	1300
Imported Coal (ktpa wet)	560	1120
Lime (ktpa)	70	140
Dolomite (ktpa)	70	140
Lime Kiln Dust (ktpa)	6	12
Natural Gas (TJ/a)	1480	2960

Table 3.1
Commercial HIsmelt Plant Key Characteristics (contd)
(Estimates at time of preparation of the PER)

ELEMENT	DESCRIPTION	
Iron Ore Stockpiles (kt)	56 and 10	56 and 10
Coal Stockpile (kt)	57	57
Dolomite Stockpile (kt)	35-50	35-50
Pig Iron Stockpile (kt)	60	60
Slag Stockpile (kt)	0-100	0-100
Air Separation Unit - Oxygen Production (tpd) - Nitrogen Production (tpd)	880 800	1760 1600
Greenhouse Gas Emissions (tonnes of CO_2/tonne of hot metal)	1.86	1.86
Greenhouse Gas Emissions (Mtpa CO_2 gross)	1.5	3
S0x Emissions - normal operations g/sec (tpa)	9 (250)	18 (500)
N0x Emissions g/sec (tpa)	21.8 (603)	43.6 (1206)
Particulate Emissions g/sec (tpa),	2.3 (64)	4.6 (128)
Water Usage kL/hr (GL/a)	405 (3.2)	810 (6.4)
Water Source	Kwinana Wastewater Recycling Plant	
Construction Period (months)	20 – 24	20-24
Power Generation – Number of Turbines	1	2
Power Generation (MW)	20	40
Emergency Power Supply (Standby from the grid) (MW)	10	10
Plant Area (ha)	21.1	36
Solid Waste (ktpa)	6-10	12-20
Process Effluent (Plant expected to be in water balance).	0	0
No of Truck Movements (per day)	73	146
No of Ore Train Movements (per week)	10	20
Ship Movements (per year)	30 - 50	60 - 100
Workforce Numbers	65	125
Construction Noise	Comply with *Environmental Protection (Noise) Regulations, 1997.*	
Operational Noise at Residential Areas.	At least 5dB(A) below the assigned noise levels at residential areas.	
Operational Noise – Boundary dB(A)	65	65
Road Noise Increase in L_{Aeq} dB(A)	0.0	0.0
Rail Noise Increase in L_{Aeq} dB(A)	0.1	0.2
Noise – Shipping Operations	At least 5dB(A) below the assigned noise levels at residential areas.	
Risk at Plant Boundary	Less than fifty in one million per year.	
Risk at Residential Area	Less than one in one million per year.	



HIsmelt®

Commercial HIsmelt Plant
RESPONSE TO SUBMISSIONS

PROCESS FLOW DIAGRAM

Figure 1

4. RESPONSE TO SUBMISSIONS

4.1 TECHNOLOGY/SUSTAINABILITY

HIsmelt is encouraged to lead the way in environmentally sound initiatives and sustainable industry practices.

One of the main drivers for the development of the HIsmelt Process has been the requirement for an ironmaking process that has a superior environmental performance to conventional processes. By eliminating the need for coke plants and sinter plants, the HIsmelt Process helps remove the two major sources of emissions from integrated iron and steel plants. The flexibility in design that HIsmelt offers will result in the installation of Plants tailored to meet regional requirements and with a smaller environmental footprint when compared to an integrated plant that must be designed for the production of large tonnages. The HIsmelt Process meets the principles of sustainable development as discussed in Section 2.4 of the PER and will assist the iron and steel industry to become more sustainable.

This Project is not consistent with the Premiers commitment to sustainability and the Government's discussion document " Focus on the Future: Opportunities for Sustainability in Western Australia".

The Project is consistent with aspects of the discussion document "Focus on the Future: Opportunities for Sustainability in Western Australia" including the following:

- In the section titled 'A challenge and opportunity', the document discusses the need for a reduction in the consumption of resources and an improvement in resource efficiency. Through its ability to use iron ores that are unsuitable (or only marginally suitable) for use in conventional iron making processes the Project will contribute to a reduction in mining waste and an increase in useful iron ore reserves in WA's iron ore mines. The Process has a lower energy intensity than conventional iron making technology, which also supports sustainability.

- Also documented in the section titled 'A challenge and opportunity' is the requirement for rapid transfer of knowledge and technology to developing countries. The Proponent has identified developing countries in Asia as a major growth area for the proliferation of the HIsmelt Process. The inclusion of Shougang as a Joint Venture participant in the Project is an indication that this growth will occur following successful commercial implementation of the Process at Kwinana.

- The aim of the State Sustainability Strategy is to promote ideas on how Western Australia can harness the new opportunities from the global sustainability challenge. The Proponent, in its PER, has stated that it represents the future as far as the global iron and steel industry is concerned and that this development is an example of 'harnessing global opportunities in sustainability'.

- In the section titled 'Global and local sustainability issues – The global context' the document correctly identifies sustainability as a global issue. The PER (Sections 2.4 and 7.4) discusses that successful commercialisation of the HIsmelt Process at Kwinana will lead to positive environmental outcomes throughout the world as the technology replaces existing iron making processes.

- The document states that 'Western Australia can play a positive role in helping address global issues while focusing on achieving a sustainable future for the State' and '....can assist with knowledge and experience in sustainability services and technology'. The HIsmelt Process, developed in Western Australia, is an example of this.

- In the section titled 'A focus on Western Australia' the document states that 'Accordingly, a major challenge we face is the need to diversify our industrial base, particularly our export capability and our ability to value-add to raw materials'. This Project represents such a new value adding industry.

- The section titled "A focus on Western Australia" also discusses the need for innovation and eco-efficiency – the HIsmelt Process represents an innovative and more eco-efficient method of processing iron ore.

The Town of Kwinana requested that the evaluation process used to determine that the waste heat recovery system is the most energy efficient and lowest cost scenario be specified.

From flowsheet modelling and test work undertaken at the HRDF it was known that the process offgas contained a significant quantity of both thermal and chemical energy. Options for recovering and utilising this energy were investigated including the following:

1. Use of the process offgas to dry, preheat and partially reduce iron ore prior to its input to the smelting vessel.
2. Use of the process offgas to heat the Hot Blast Stoves (replacing natural gas).
3. Use of the thermal energy content to generate steam.
4. Combustion in a waste heat recovery system to generate electricity.

The Plant design is based on a combination of all of the above four options. The reasons for this outcome are as follows:

1. It was decided to include a Preheater module as this represented the best method for maximising the productivity of a HIsmelt SRV with a diameter of 6 metres. However, the Preheater is constrained by both inlet and exit gas temperatures. A mass and energy balance for the Preheater (developed in conjunction with the supplier of the Preheater, Lurgi, a German engineering company) determined the optimum quantity of offgas and iron ore that could be passed through the Preheater, which represents approximately 50% of the total offgas flow. The inlet temperature is constrained to a maximum of 1000°C.

2. The use of blast furnace offgas to heat Hot Blast Stoves is an accepted practice in integrated iron and steel plants. As the SRV offgas has a similar composition to blast furnace gas its use as a fuel in the stoves was found to be feasible and the flow sheet was therefore developed to accommodate the use of SRV offgas to heat the stoves.

3. The SRV offgas will exit the SRV at a temperature of around 1450°C. Due to the constraint on the maximum temperature at the inlet to the Preheater and also the inlet to the wet scrubber (both 1000°C) there will be a requirement to cool the offgas from 1450°C to 1000°C. This will be accomplished by passing the gas through the water cooled offgas hood. At the HRDF the cooling water in the offgas hood was passed through a plate and frame heat exchanger, with the heat being rejected through a cooling tower. As that represented a waste of energy the decision was made to design the offgas hood on the commercial scale Plant to be a steam circuit, the heat removed resulting in the generation of a significant quantity of saturated steam. The use of this steam is discussed below in point number 4.

4. The Hot Blast Stoves will not consume all of the SRV offgas that is available as a fuel and the Preheater offgas will also be available as a fuel. In order to capture the energy content of these gas streams the Waste Heat Recovery system was incorporated into the Plant flowsheet to combust the gas, produce steam and generate electricity from the steam. The WHR system was chosen due to the fact that the fuel is a mildly sour gas that would be unsuitable for use in a Combined Cycle Gas Turbine type system. The steam from the offgas hood is superheated in the WHR system and combined with the steam generated in the WHR. The PER outlines the rationale behind the decision to use some of the steam to generate electricity and the remainder to drive the ASU compressor and HAB blower (Section 3.6.2 of the PER).

The only portion of offgas energy that will not be recovered is that associated with the cooling of the SRV offgas from 1000°C to 90°C in the wet scrubber. It would be possible to cool the gas further prior to scrubbing, with the generation of additional steam. However, this would have the potential to cause problems in the process due to the formation of accretions in ducts (at temperatures below 800°C alkali species condense out of the gas phase onto water cooled steelwork, particulates in the gas stream become entrained in the deposits ultimately causing restrictions to gas flow and increased pressure).

4.2 WATER SUPPLY

The EPA Service Unit states that the PER indicates that the Proponent's preferred option is to have water supplied from the Water Corporation's proposed Kwinana Wastewater Recycling Plant (KWRP), if feasible. From an environmental perspective, this option is preferred over scheme water. If the KWRP is not available in a timely manner, can the proposed plant be retrofitted to allow this option to be utilised once it is operating?

The DEWCP (Kwinana) stated that it is unlikely that sufficient scheme water could be sourced from the Water Corporation to meet the HIsmelt Plant requirements. Water from the proposed Kwinana Wastewater Recycling Plant should be used.

The Water Corporation stated that it would prefer that the Proponent sources water from the KWRP, provided all approvals are obtained for the Project, in order to reduce the demand for scheme water. A Proponent commitment to that effect should be made.

The Cockburn Sound Management Council strongly supported the water to be sourced from the waste water recycling proposal.

The Kwinnana Town Council states that the use of scheme water is unacceptable. The Water Corporation, DEWCP and all other stakeholders should be encouraged to progress the development of the Kwinana Wastewater Recycling Plant.

The City of Cockburn stated that the Proponent should be required to use an alternative water supply to scheme water.

The proposed water consumption is far too high to permit the use of scheme water. Alternative sources of water exist to meet industry needs without relying on this precious, finite resource.

At the time of preparing the PER the only available water supply for the Project was scheme water although it was stated in the PER that the Proponent's preferred option would be to use water from the proposed Water Corporation's KWRP.

The Proponent had discussed with the Water Corporation the possibility of using KWRP water. However, the Proponent was unable to commit to using the water from the KWRP until a decision by the Water Corporation to proceed with the proposal had been made.

The Premier of Western Australia, Hon Geoff Gallop, announced on the 24 May 2002, that the Water Corporation would build a water recycling plant in Kwinana. The plant would initially be capable of processing five Giga Litres of treated municipal wastewater per year to a quality suitable for use by major Kwinana industrial customers. The plant will be built, owned and operated by the Water Corporation and will be commissioned in early 2004. One benefit of the plant is that it would reduce the amount of industrial wastewater that is discharged by about 6ML per day. In addition there would be a reduction in the treated wastewater flow from the Woodman Point Wastewater Treatment Plant through the Cape Peron outfall due to industry using a significant amount of treated wastewater that would otherwise be discharged to the ocean.

Discussions with the Water Corporation have continued and a mutually agreed Letter of Understanding between HIsmelt and the Water Corporation has been prepared. This is the Proponent's preferred option and it is presumed that mutually acceptable terms and conditions will be reached by the two parties.

The consequences of HIsmelt being able to act as a major catalyst to enable the Water Corporation's KWRP are significant for water supplies and the environment in terms of the following.

1. When HIsmelt uses water from the KWRP there is no increase in consumption because it uses water that is currently waste and being discharged from the Cape Peron outfall. (This is equivalent to about 10,000 t/day, or 68,000,000 litres per week for Stage 1 and double these amounts for Stages 1 and 2).

2. With HIsmelt as the catalyst to establish an economic KWRP other industries can also use what is currently wastewater. This will have a positive impact by making more of the existing scheme water available for domestic consumption (estimate up to 10,000 t/day).

3. Because the KWRP produces water that has a low total dissolved solids content, less water treatment chemicals will be required within the water circuits. The water can be recycled more times before it has to be rejected from the circuit and used for slag cooling or pig cooling.

4. There are further opportunities that are currently under investigation, where wastewater from nearby industry that is discharged into Cockburn Sound could be used for cooling pig iron or slag with a highly positive environmental benefit.

The Plant is being designed to accept water from both the KWRP and scheme water (this is necessary from a Plant safety standpoint, a guaranteed supply of fire water must be available at all times and a back up source of cooling water is also required in case the KWRP supply develops problems). Thus in the unlikely event that the KWRP is delayed beyond the commissioning of the HIsmelt Plant a change to KWRP from scheme water would simply involve opening or closing a number of valves.

The Plant would consume the total of the Woodman Point Water Treatment Station if it were to be treated to a suitable level. However, given the water shortage in Perth and the likelihood of delays in implementing this Project, the HIsmelt proposal will have a significant impact on Perth's water supplies.

The current estimate of the wastewater flow from the Woodman Point Waste Water Treatment Plant to the Cape Peron outfall is 100ML/d (Water Corporation Brochure 'WA21 The Woodman Alliance', 2000). If the entire flow was processed through a Micro Filtration and Reverse Osmosis plant, as the Water Corporation has planned for Kwinana, the product stream would be ten times that required by the Stage 1 Plant, and five times that required for the Stage 1 and 2 Plants combined. The proposed KWRP is planned to process approximately 18ML/d of the Woodman Point secondary treatment effluent to produce a high quality water for industrial use. The HIsmelt Stage 1 Plant will take approximately 8 - 10ML/d of its output. This water will be supplied under normal commercial terms; the Water Corporation expects the project to achieve a rate of return on capital invested that is consistent with its internal guidelines. For the Stage 2 HIsmelt Plant it is anticipated that the KWRP would be expanded to meet the extra demand. This is in line with the State Government strategy to maximise the re-use of the secondary effluent from Woodman Point.

Note that the recycling of what would otherwise be a waste stream has the following advantages:

- It effectively increases the water resources available to the Water Corporation.
- A reduced effluent flow to the Cape Peron outfall, which has environmental benefits.
- The capacity of the Cape Peron line to cope with expansion of the Metropolitan Area is enhanced through the removal of 20% of current flow, thereby delaying the requirement to build additional effluent disposal infrastructure.

The Proponent is working closely with the Water Corporation to ensure that the KWRP Project Schedule is such that the water will be available at the time of commissioning of the Stage 1 Plant.

4.3 AIR EMISSIONS

4.3.1 General

HIsmelt is encouraged to continue implementing and employing the best available technology to further reduce levels of air emissions where possible.

The Proponent will implement all reasonable and practicable measures to prevent the discharge, emission or transmission of pollutants from the Plant as required by Section 51(2) of the *Environmental Protection Act, 1986*. Practicable is defined in the Act as meaning "reasonably practicable having regard to among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge".

The Proponent has investigated and will implement the best available technology for reducing air emissions. This includes a Flue Gas Desulphurisation System, bag filters, wet scrubbers, and low NO_X burners. The Proponent will monitor to ensure that the technology implemented in the Plant results in emissions at or below the levels predicted in the PER. The Proponent will continue to investigate best available technology during the life of the Project and implement best available technology where practicable (e.g. when replacing, or installing additional, equipment modules). Where improvements can be made by changes to operating procedures these will be implemented immediately.

The Town of Kwinana requested that HIsmelt characterise all gaseous emissions from the Plant.

The City of Cockburn stated that the proposal must be subject to the limits and standards of the EPP and the cumulative limits and standards for the EPP are not exceeded as a result of the Stage 1 or Stage 2 of the Project.

Table 4.9 in the PER (page 4-35) lists the stack parameters and emissions under normal operations for both the Stage 1 and Stage 2 Plants. The key characteristics table, which is provided in the PER and is contained in Section 2.0 of this document, also lists the gaseous emissions expected from the Plants.

As discussed in the PER (Sections 5.3 and 7.3) the Kwinana region is covered by the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy (EPP). The EPP defines limits (concentrations of atmospheric wastes that shall not be exceeded) and standards (concentrations of atmospheric wastes that shall not be desirably exceeded) for SO_2 and particulates. The limits and standards are presented in Table 7.1 in the PER. Emissions of other atmospheric pollutants are to meet the National Environmental Protection Measures (NEPM) standards, which were presented in Table 7.2 of the PER.

The PER reports the levels of emissions and the resulting modelled ground level concentrations of SO_2 and NO_X. All of the emissions from the Plants are well within the acceptable EPP and NEPM standards.

HIsmelt was allocated a maximum permissible emissions rate for SO_2 for the operation of the HRDF. This allocation was included in the DISPMOD model used by the DEP in its 1992 determination for industry emissions under the EPP. Although the two stages of the commercial HIsmelt Plants will result in a sixteen times scale up of the HRDF, the Proponent will implement best practice technology to ensure that the SO_2 emissions are minimised and will not be seeking an increase to their allocated maximum permissible quantity emission rate.

The EPA Service Unit states that Table 4.9 in the PER provides stack parameters under normal operations. However, the Proponent should provide an equivalent table to account for maximum worst case stack emissions under abnormal operations for both the Stage 1 and Stage 2 plants. This is especially important from a licensing perspective given that licensing conditions are usually formulated around maximum worst case stack emissions.

The data in Table 4.9 are the expected emission levels for Plant design operations. The other operating modes that may cause a change in the SO_2 emission level are discussed in Section 4.20.4 of the PER. For these abnormal operating conditions it is estimated that the worst case emission rate of SO_2 from one Plant will be 24g/sec for a period of 15 to 30 minutes. If this is at the same time as a start up of the other Plant then the worst case emissions will be 35g/sec as discussed in Section 4.20.4 of the PER. All other emission levels predicted will be as shown in Table 4.9 for Plant operations.

The City of Cockburn states that the proposed Plant will be the first commercial application of the Process and the stated emissions are theoretical and may be well exceeded under full production. It is questionable that this Process should be permitted due to the possible risks.

Rio Tinto has been developing the HIsmelt Process since 1981 as discussed in Section 1.2 of the PER. Successful testing of the smelt reduction concept technology was undertaken in Germany between 1984 and 1990. The HRDF tested the Process in a semi-continuous mode under a wide range of operating conditions between 1993 and 1999. A wide range of iron and coal feed materials were successfully tested and the essential features and the engineering viability of the vertical vessel demonstrated.

In parallel with the HRDF operations a computer based heat and mass balance model was developed to provide a tool for process development. This model was validated with HRDF data and now has the capability to predict the performance of a wide range of plant configurations and feed materials. The model uses conservative assumptions as far as emissions are concerned so that actual performance should meet the levels outlined in the PER as a minimum. Additional confidence has been achieved through the application of computerised fluid dynamics to explain top space and bath interactions. Again these CFD models have been validated with HRDF data.

The commissioning plan for the Plant also represents a conservative ramp up to full production in order to fully validate that the Plant is performing as designed. This ramp up period will be at less than full production further ensuring emissions are within the predicted levels. Should the Plant not meet emission criteria corrective action will be taken to ensure compliance with the limits presented in the PER.

The Town of Kwinana asked that if different types of ores are trialled at the Plant how will the emissions from these ores be licensed? HIsmelt should consult with all stakeholders should they use ores that have not been assessed during the PER process.

The Project has focused on using iron ore fines from Hamersley Iron's Pilbara and Portman's Koolyanobbing iron ore fines. However, one of the benefits of the HIsmelt process is that other iron feed materials other than iron ore can be used. During the testing campaigns at the HRDF the following iron materials were trialled:

- three types of Pilbara ores;
- Direct Reduced Iron from South Africa;
- Hot Briquetted Iron from Malaysia ;
- Millscale (a waste that is generated during the casting of steel); and
- some wastes from integrated steel plants.

The processing of these materials did not change the emissions.

The Proponent may wish to trial other iron bearing materials in the Plant as discussed in Section 4.5.4 of the PER. The use of any feed material, other than iron ore, will be subject to approval from the DEWCP. The Proponent will ensure that any materials that may be trialled do not result in any exceedance of the predicted emissions presented in the PER.

The EPA Service Unit states that the first paragraph of Section 4.11.3 on page 4-20 of the PER indicates that the Plant Control System will monitor and collect measurements of SO_2 concentrations from the stack on a continuous basis. Can the Plant Control System be designed to monitor and collect measurements of NO_X and CO?

Additional information and a commitment are required from the Proponent in regard to the installation of continuous gas monitors as this is considered to be best available technology.

The preliminary design for the Plant includes the provision for a Continuous Emissions Monitor (CEM) on the main stack (after the FGD), with the capability to monitor for SO_2, NO_x and CO. Process control of the FGD requires continuous SO_2 measurement data, and hence the Proponent was able to make the commitment in the PER. During the detailed design phase the CEM will be addressed in more detail, particularly with regards the capability to measure these species in a sample gas stream that has been extracted from a wet stack. If measurement for NO_x and CO is proven feasible then the data will be collected and stored by the Plant Control System.

4.3.2 Health Impacts

Health impact studies should be undertaken in the Kwinana area on a regular basis.

The high levels of air pollutants that would be emitted are unacceptable and contain substances harmful to the health of the communities.

The Town of Kwinana stated that a multi pathway exposure and health risk assessment should have been undertaken for the HIsmelt Project.

The Proponent is asked to commission a health impact assessment to include the impact from NO_X, SO_2, CO, CO_2, Heavy Metals, Dioxins ,Furans, VOC, PAHs and particulates.

A health study for the Kwinana area would be much broader based than is directly related to the HIsmelt Project and for the Kwinana Industries in general. The Proponent would support a study by the Government and/or the Kwinana Industries Council to determine the levels of air pollutants being emitted by Kwinana industries.

The major concerns being raised by the Kwinana community in relation to the health impacts from industry relate to Dioxins, Furans, heavy metals PAHs, VOCs, and POPs. In response to the concerns raised in the submissions the Proponent has prepared a report on the Assessment of Human Health Issues relating to the Project. The report has been submitted to the Air Quality Management Branch of DEWCP, and the Environmental Health Division of the Department of Health. A copy of the Assessment of Human Health Issues report is presented as Appendix A of this document.

4.3.3 Sulphur Dioxide

The City of Rockingham states that the PER contains no information on the likely SO_2 emissions if the low sulphur coal is not used. The Proponent should make a formal commitment to use low sulphur coal or be required to carry out additional modelling to predict SO_2 levels where high sulphur coal is used.

Section 7.3.3.12 of the PER state that the coal specifications provided to potential suppliers include an upper limit sulphur content of 1% on a dry basis, with a preference for the sulphur content to be less than 0.8%. The SO_2 emission rates that were modelled for the PER were based on the flowsheet that assumed a coal sulphur content of around 1%.

The EPA Service Unit states that the second paragraph of Section 4.15 on page 4-26 of the PER indicates that the flue gas desulphurisation (FGD) system will have a SO_2 removal efficiency of at least 95%. Is this a claim made by the system's manufacturer given that Table 3.4.5 on page 96 of the Draft Reference Document on Best Available Techniques for Large Combustion Plants (European Commission, 2001) indicates that general SO_2 reduction rates for FGD systems which utilise wet lime/limestone range from 90% to 95%? Whilst it would be beneficial for the proposed FGD system to exceed current best practice SO_2 emission levels, can the Proponent please clarify whether the claimed SO_2 removal efficiency of at least 95% is accurate, and in fact realistically achievable.

The Proponent has held discussions with several manufacturers of FGD systems, both for the current Project and previously during a detailed feasibility study for the installation of a HIsmelt Plant in the United States. All vendors reported that, using a wet lime or limestone based FGD, a removal efficiency of 95% was achievable and that they would provide process guarantees to back up this claim. The efficiency is a function of the design of the FGD, extra spray bars being installed to provide increased gas/liquid contact surfaces. The FGD is being required to achieve the 95% removal efficiency at a sulphur dioxide loading in excess of that anticipated if a coal at the high end of the sulphur specification range is used. It is thus expected that the guaranteed removal efficiency will apply regardless of the sulphur content of the coal.

The City of Rockingham states that the commitment to report SO_2 on a six monthly basis is inadequate. The Proponent should also be required to report to the DEWCP immediately any incidence of elevated emissions and the reason for the variation.

A continuous emissions monitoring instrument will measure SO_2 emissions in the gas stream exiting the main stack of the Plant as discussed in Section 7.3.3.13 of the PER. The Proponent will report the monitoring data to the DEWCP on a monthly basis. Any exeedances of the maximum permissible emission rate will be reported to the DEWCP within the timframe designated by the DEWCP. The reason for the exceedance will be investigated and the findings reported to the DEWCP.

4.3.4 Nitrogen Oxides/Smog

The EPA Service Unit states that the first dot point in Section 7.3.5.4 of the PER indicates that the process offgas has a low calorific value and will tend to burn with a low flame temperature of around 950°C. The EPA Service Unit acknowledges that this will reduce the amount of NO_X produced during combustion, and therefore negate the need to use other NO_X control measures such as low excess air, flue gas recirculation and water injection. However, Section 7.3.5.4 does not indicate whether the Proponent has considered the use of post combustion flue gas NO_X control measures such as selective catalytic reduction (SCR) systems (i.e. ammonia injection) and selective non-catalytic reduction (SNCR) systems in the Waste Heat Recovery System, the Hot Blast Stoves, and any other part of the Plant that will burn process offgas? Can such systems be utilised in these areas of the Plant? If they cannot be used, the specific reasons why this would be the case need to be provided together with copies of appropriate advice received from the relevant equipment manufacturers to justify any claims made in this regard.

The EPA Service Unit asks where low NO_X burners will be used in the Plant to burn natural gas, can other additional NO_X control technology such as low excess air (LEA), over fire air (OFA), fuel reburning, and flue gas recirculation (FGR), selective catalytic reduction (SCR) systems (i.e. ammonia injection), and selective non-catalytic reduction (SNCR) systems etc be used in conjunction with them to further reduce NO_X emissions to best practice levels? If they cannot be used, the specific reasons why this would be the case need to be provided together with copies of appropriate advice received from the relevant equipment manufacturers to justify any claims made in this regard.

All of the above comments and questions are related to NO_x control technology, therefore, to avoid repetition the Proponent has provided the following response to address the comments and questions.

The flame temperature in the Waste Heat Recovery (WHR) system is expected to be in the range 860 – 950 °C. This is at the low end of the optimum temperature window for Selective Non-Catalytic Reduction techniques for NOx reduction. If ammonia injection is used a temperature range of 870 - 1038°C is required while a temperature range of 950 - 1038°C is required for urea injection. A residence time of 1 – 2 seconds in the temperature range is required for the technique to be effective. A combination of low temperature and short residence time can result in ammonia slip (ammonia passing through into the flue gas). These conditions cannot be achieved in the WHR system, as heat will be rapidly removed for the generation of steam.

Selective Non-Catalytic Reduction systems also work best when the temperature of the flame is relatively constant. This is difficult to achieve in the WHR system due to the fact that the gas composition will vary due to process variations and fuel gas flow rates due to varying quantities being required in the stoves at different times.

Selective Catalytic Reduction, where the ammonia injection occurs at a lower temperature (300 - 425°C) upstream of a bed of a catalyst is a technique that is employed to reduce NOx emissions. However, the presence of SO_2 in the flue gas 'poisons' the catalyst. As the optimum temperature range would only be achieved upstream of the FGD system this technique cannot be employed at the HIsmelt Plant due to the SO_2 levels in the flue gas stream.

The flue gas will be scrubbed for SO_2 prior to release to atmosphere in a wet lime based FGD. It is possible that this will result in some reduction of NO_x emissions as NO_2 is moderately soluble in water. However, as the proportion of NO and NO_2 in the flue gas is unknown the flowsheet assumptions for NO_x emissions do not include any allowance for absorption in the FGD.

(Reference for above 'NOx Controls for Steel Industry Sources', E. Joseph Duckett, AISE Steel Technology, April 2002 – available at www.steeltechnology.org).

The EPA Service Unit notes from Table 4.9 in the PER, that NO_X emissions from the main stack, coal mill stack, and Pre-heater stack will be 157mg/Nm^3, 48mg/Nm^3, and 71mg/Nm^3 respectively (7% O_2, dry). Can the Proponent please indicate what the averaging time is for these quoted NO_x emission concentration values? Can the proponent clarify whether they represent best practice levels when compared to relevant European Commission (EC) and US EPA standards for NOx emission concentrations from iron and steel production plants and large combustion plants etc?[please provide appropriate references]

The EPA Service Unit asks are the process offgas burners that will be used in the Plant considered to be best available control technology? If they are, can the Proponent please provide suitable evidence and references to justify any claims made in this regard. If they are not, can the Proponent please provide detailed justification for not utilising process offgas burners that are best available technology.

Evidence is required to confirm that the proposed type of burners to be used will keep NO_X emissions as Low as Reasonably Practicable. Are the process offgas burners that will be used in the Plant considered to be best available control technology?

The emissions presented in Table 4.9 of the PER are considered to be "achievable" and the maximum levels that are likely to occur over any averaging time. Achievable is defined in the European Commission document (European Commission, 2000) as those levels that may be expected to be achieved over a substantial period of time in a well maintained and operated installation or process using those techniques. The specific averaging period will depend upon the duration of sampling, which is likely to be around 30 minutes.

The burners used to combust Process Gas have been demonstrated to be Low-NOx burners through their use of staged combustion and induced flue gas recirculation. The oxygen content of the flue gases is less than 3% on a dry basis, which is the same as that achieved in Low Excess Air burner systems. A discussion on the burners to be used in the system follows.

Waste Heat Recovery System

The proposed Waste Heat Recovery system will be designed to operate with off gas flows between 151,000 Nm^3/hr and 230,000 Nm^3/hr, and with off gas qualities of 0 MJ/Nm^3 to 3.0 MJ/Nm^3. Under normal operation, with the lower heating value of the off gas at approximately 2.0 MJ/Nm^3, the system will operate at a combustor temperature of approximately 864°C.

The combustion system will consist of :

- a Cyclonic Combustor,
- an auxiliary burner with fuel train / Burner Management System (BMS), and
- combustion air fans, instruments and controls.

The combustion chamber will be a cylindrical carbon steel shell, with internal refractory and insulation. It will be arranged horizontally, with a 90° turn prior to entering the downstream heat recovery equipment. In the Cyclonic Combustor, off gas will be introduced tangentially, imparting a cyclonic "swirl" pattern within the cylindrical shell of the combustion chamber. The combustion air will be injected via high-velocity radial jets to penetrate and mix with the off gas stream (staged combustion). Such a cyclonic flow pattern will ensure quick and efficient oxidation of the combustibles in the off gas. A refractory choke ring, within the shell, will help to recirculate the products of combustion (i.e. flue gas recirculation a known NO_x control technique) and facilitate mixing with the fresh combustible gases.

The flue gas temperature will be used as the means of demonstrating a stabilised flame and complete combustion of the offgas stream.

The flow of combustion air to the combustion chamber will be controlled by an oxygen analyser, maintaining a constant level of approximately 1.5% to 2.0% O_2 in the exhaust gas (i.e. Low Excess Air).

Auxiliary Burner

A low-NO_x forced-draft register burner type auxiliary burner will be provided at the gas inlet end of the combustion chamber.

During a cold start-up, when the off gas is not available, natural gas will be used as an auxiliary fuel to warm up the WHR System and provide start-up steam for the Plants. The natural gas burner will be sized to produce a minimum of 100,000 kg/hr of steam from the heat recovery system.

When the off gas quality (fuel value) falls below the minimum required to maintain stable combustion, the auxiliary burner will automatically cycle on. This feature will maintain a minimum combustion temperature of 850°C, to ensure adequate destruction of the CO and any hydrocarbons in the off gas. The auxiliary burner will be sized to maintain a combustor temperature of 850°C at a maximum off gas flow of 230,000 Nm^3/hr, entering with a "zero heating value".

The EPA Service Unit states that in view of the likely NO_X emissions from the proposed Global Olivine Western Australia Limited (GOWA) Waste to Energy Plant in Kwinana, additional modelling should be undertaken to enable an assessment of the cumulative impact of NO_X emissions from both the HIsmelt and GOWA plants to be made. In order to achieve this, NO_X emissions from the HIsmelt Plant (Stage 1 operating alone, and Stage 1 and Stage 2 operating concurrently) and the GOWA plant need to be modelled together in DISPMOD and the results added to monitored data. The results obtained from the above cumulative modelling should then be compared with the applicable NEPM standard.

The assessment in the PER for the cumulative impact of NO_X emissions used only the existing NO_X emitting sources. To undertake an assessment of the additional impact of the proposed Global Olivine Western Australia (GOWA) Waste to Energy Plant, further modelling was undertaken using the following:

- The same model, DISPMOD and parameters as described in the PER.
- A NO_2/NO_X ratio from the equation used within the assessment of the Compact Steel Project (Dames & Moore, 1993). This equation predicts a ratio that is less conservative than the 100% ratio used in the PER, but is still considered slightly conservative, especially for the higher NO_X concentrations.
- Emissions from the GOWA plant were based on two plants operating, with the 95 percentile emissions (which are actually 95.4 percentile) emission of 92 g/s applied (Barker & Associates, 2000). The use of the 95 percentile emission rate is consistent with the Victorian EPA recommendations (EPAV, 1983) for modelling moderate size emitters of class 1 pollutants such as NO_2. In reality, the emissions from GOWA are predicted to be highly variable with emissions:
    - less than 38 g/s occurring for 45% of the time;
    - less than 64 g/s occurring for less than 80% of the time; and
    - a maximum of 123 g/s occurring for no more than 0.5% of the time.

As such, modelling at the 95 percentile emission rate will be conservative, as the probability of worst case dispersive conditions occurring with worst case emissions will be extremely unlikely as shown in the GOWA assessment (see Barker & Associates, 2000, Table 9-7).

The results for the predicted ground level concentrations from the GOWA and HIsmelt Plants are presented in Table 4.1.

Table 4.1
Summary of Predicted NO_X and Implied NO_2 ($\mu g/m^3$) Levels from the GOWA and HIsmelt Plants

Source	Concentration ($\mu g/m^3$)			Percentage of NEPM for any Residential Area within B and for Area C (%)
	Area A Industrial	Residential Areas within Area B Buffer	Area C Residential	
		Maximum 1-hour		
Global Olivine	251 (124)	105 (58)	105 (58)	23.5
HIsmelt (2 stages)	186 (97)	85 (47)	77 (43)	19.1
Combined	312 (147)	175 (92)	123 (67)	37.4
		Annual Average		
Global Olivine	2.54 (1.5)	2.0 (1.2)	1.05 (0.62)	1.9
HIsmelt (2 stages)	2.89 (1.7)	1.6 (0.94)	0.77 (0.45)	1.5
Combined	5.43 (3.2)	3.5 (2.1)	1.8 (1.1)	3.4

Notes:

The first values are the NO_X concentrations with the corresponding values of NO_2 in brackets

The NEPM 1-hour and annual standard of 0.12 and 0.03 ppm has been converted to 246 and 62 $\mu g/m^3$

Data in Table 4.1 indicate that the:

- concentrations from both the GOWA Plants will contribute 23.5% of the NEPM standards and the HIsmelt Plant will contribute 19.1 % of the NEPM standard;
- cumulative contributions from the GOWA and HIsmelt Plants to the maximum 1-hour concentrations will be 37.4% of the NEPM standard occurring at residences within Hope Valley. This is less than the addition of the two as the maximum ground level concentrations from the GOWA and the HIsmelt Plants will occur at different locations and different times, due to their relative positions of the stacks and the different final plume heights; and
- cumulative contributions from the GOWA and HIsmelt Plants to the annual average will be 3.4% of the NEPM standard at residences within Hope Valley.

Cumulative NO_2 concentrations from the proposed GOWA and HIsmelt plants and existing sources (industry, motor vehicles etc) are presented in Table 4.2.

Table 4.2
Summary of Predicted Cumulative NO_2 levels at Hope Valley and North Rockingham

Source	NO_2 Concentration ($\mu g/m^3$)		Percentage of NEPM (%)	
	Hope Valley	North Rockingham	Hope Valley	North Rockingham
Maximum 1-hour				
Existing	93.2	83.6	38	34
Proposed HIsmelt and GOWA	85.6	35.7	35	14.5
Existing, Proposed HIsmelt and GOWA	136.3	88.1	55	36
Annual Average				
Existing	8.4	9.7	13.5	15.6
Proposed HIsmelt and GOWA	1.7	0.31	3.2	0.6
Existing, Proposed HIsmelt and GOWA	10.1	10.0	16.3	16.1

Note: The NEPM 1-hour and annual standard of 0.12 and 0.03 ppm has been converted to 246 and 62 $\mu g/m^3$

Data in Table 4.2 indicate that existing maximum 1-hour NO_2 concentrations at Hope Valley may increase from 38% to 55% of the NEPM standard with the operation of both the GOWA and the HIsmelt Plants. At North Rockingham the concentrations will increase from 34 to 36%. Annual average concentrations are predicted to increase slightly to approximately 16% of the NEPM standard for NO_2.

The Town of Kwinana requested that the cumulative impact of NOx that may combine with other VOCs and ROCs emitted by other industries in Kwinana should be considered in the formation of smog.

The cumulative impact of NO_X and other VOCs and ROCS emitted by industries and the effect on smog levels within Perth was addressed in Section 7.3.6 of the PER. The PER provided a review of the relative change in Kwinana and Perth emissions and the implications that this has on smog levels as determined by modelling undertaken in the Perth Photochemical Smog Study (PPSS) (WPC and DEP, 1996). It was concluded that the addition of the HIsmelt Plants would have a negligible impact on Perth ozone levels.

To quantitatively evaluate the impact, modelling using a photochemical model as employed during the PPSS is required. Such an assessment has recently been undertaken by Western Power and reported in the Strategic Environmental Assessment for the Kwinana Mason Road Power Station (SKM, 2002b). The assessment used models developed within the PPSS for a number of changes to Kwinana industry emissions, including the addition of GOWA and a possible 1,080MW combined cycle power station.

A summary of the results for the Western Power study for three typical worst case days modelled are presented in Table 4.3. The 1994/1995 and 2001 emissions case represent concentrations that would have resulted using the emissions for these years.

Table 4.3
Peak Hourly Average Ozone Concentration (ppb) for Potential New Industry within Kwinana

Meteorology Modelled	Pollution Event Type	1994/1995 Emissions	2001 Emissions	2001 Emissions with GOWA	2001 Emissions with GOWA and Stage B replacement	2001 with GOWA, Stage B Replacement and Proposed Power Station
16 March 1994	Inland	90.4	87.6	86.6	86.0	85.6
10 February 1995[1]	Coastal	116.4	109.5	108.3	109.7	109.4
6 January 2001[2]	Inland		117.0	117.0	117.0	117.0

Source Sinclair Knight Merz (2002b)

Notes:

1) Maximum over western 2/3 of grid, ignoring inland errors on this day
2) Variations of peak concentrations are only 0.03 ppb

The results from the modelling indicate that there will be only minor impact on the maximum 1-hour ozone levels with the industry options modelled. These include the addition of GOWA and a combined cycle power station with NO_X emissions of 90 g/s. Given that the NO_X emissions from the HIsmelt Plant will be 42 g/s, which is lower than both the GOWA plant and the power station, it is considered that the HIsmelt Plant will have a negligible impact on ozone levels within the Perth region.

The NOx levels listed in the PER are those specified by the equipment manufacturers. However, it should be noted that the oxygen content of the flue gas will be controlled to be less than 3% on a dry basis, which is well below the 11% figure in the standards quoted. This use of Low Excess Air will keep the NO_x levels low.

The Cockburn Sound Management Council asked how are the NOx and nitrates emitted from the scrubbers would be prevented from entering the marine waters?

The Proponent, has no control over the fate of NOx once it has been emitted from the Plant. The Proponent, therefore, has implemented all practicable measures to minimise the emissions of NOx from the Plant.

There will be no nitrates produced in the Process and therefore it is unlikely that the water in the scrubber circuits will contain any nitrates. In any event the Proponent has stated that it is planned that there will be no discharge of effluent from the site. There will, therefore, be no release of nitrates to the marine environment.

The City of Rockingham states that the commitment to report NO_x on a six monthly basis is inadequate. The Proponent should also be required to report to the DEWCP immediately any incidence of elevated emissions and the reason for the variation.

If continuous monitoring equipment for NO_x is installed then data will be reported monthly if required. If manual sampling for NO_x is undertaken then the results for each sampling programme will be reported to the DEWCP.

4.3.5 Heavy Metals

The Town of Kwinana states that Council, Industry and the community should be aware of the levels of emissions of heavy metals. The EPA should facilitate a study to determine these levels.

The current levels of heavy metals in the Kwinana air shed should be measured.

There is concern about the levels of air pollutants in the Kwinana area due to emissions from industry. The Proponent would support a study to be undertaken by the Government and/or the Kwinana Industries Council to determine the levels of air pollutants being emitted by Kwinana industries. Heavy metals could be one parameter measured.

The emissions of heavy metals from the furnace are not covered in any detail. The Proponent needs to provide additional information on heavy metal emissions.

The potential for heavy emissions of heavy metals is discussed in Section 7.3.9 of the PER and detailed in Section 4.12 of Appendix A.

The Town of Kwinana requested details on the results of stack testing at the HRDF and if any air toxics were detected and at what concentrations.

The EPA Service Unit asks "Can the Proponent please provide information (with suitable references) either from the HRDF monitoring data or from another source which substantiates the claim made that all heavy metals would be removed through the various scrubbing stages? Is it possible for the Proponent to provide information on the removal efficiencies that can be achieved at each stage, or to evaluate removal efficiencies on the basis of the monitoring data? Can the Proponent also provide a mass balance / flow diagram for heavy metals?"

<u>HRDF</u>

No stack testing for heavy metals was performed at the HRDF. The raw materials used in the process contained only trace levels of heavy metals. The offgas system on the HRDF consisted of an offgas hood that cooled the gas to 500 - 600°C, an offgas cooler that further cooled the gas to 200°C and a bag filter that removed the particulate material. The offgas was then combusted in a combustion chamber at the base of the main stack prior to release to atmosphere.

The cooling of the gas to 200°C prior to cleaning resulted in the heavy metals (that were volatilised in the SRV) condensing on the dust particles, predominantly as metal sulphides formed as the metal fume reacted with hydrogen sulphide. These were then removed in the bag filter. This is also the case for blast furnaces where the heavy metals are removed from the gas in the wet scrubber.

Commercial HIsmelt Plant

Experience from the HRDF, and information from other iron and steel making processes, indicates that metallic elements such as zinc, lead and cadmium will report predominantly to the SRV offgas stream as metallic vapour.

An investigation of the thermodynamics of these species indicates that they will remain in the gas as vapours at temperatures above 800°C. Half of the total present will pass into the Pre-heater, where they will condense on the hot ore particles and be recycled to the SRV, with the remainder being passed into the wet scrubber. Wet scrubbing, at a temperature between 900°C and 1000°C, prevents these species from condensing on the surface of dust particles. The low pH liquid phase in the quench zone of the wet scrubber will result in the dissolution of these elements. Should any metals pass through the wet scrubber they will be subjected to further scrubbing with water in the offgas cooler.

Combustion of the gas in the WHR will be followed by another scrubbing stage in the Flue Gas Desulphurisation (FGD) system. It is therefore considered unlikely that there will be any emissions of heavy metals to the atmosphere.

The metallic elements will remain in solution through the scrubber circuit and report in the slurry to the clarifier. In the clarifier the addition of caustic for pH control and the reaction of metallic elements with dissolved hydrogen sulphide will result in a high proportion of the metallic elements being precipitated. These will be recycled to the SRV with the clarifier sludge. Any of these metals remaining in solution will be directed to the process water tank in the scrubber circuit blowdown. The addition of lime to raise the pH to 8 will precipitate the remaining metals as hydroxides.

The offgas system for the Commercial HIsmelt Plant has been designed to have the offgas cooled at 1000°C. At this temperature the metals are present in the offgas stream as vapours. It must, however, be noted that the raw materials contain only trace levels of heavy metals so the mass flow of heavy metals in the offgas stream is low.

Removal of the metals from the gas stream will be by either of the following mechanisms:-

- Contact with the quench spray water in the top of the scrubber will rapidly oxidise the metals allowing them to dissolve in the water (which is slightly acidic due to the scrubbing of compounds such as hydrogen chloride and some sulphur dioxide from the gas);
- Metal vapour that is not contacted by the water sprays will condense on the surface of dust particles and will be removed in the venturi section of the scrubber.

The metals that dissolve in the scrubber water will then react with the hydrogen sulphide, which has also dissolved out of the gas phase, and be precipitated. The sulphides will then be removed from the scrubber water circuit in the clarifier, and report to the sludge.

Should any heavy metals pass through the primary wet scrubber they would then pass into a packed tower where the gas stream will be further cooled by water sprays. Although not designed to be a particulate scrubber it is believed that some particulate material (and any heavy metals that may have condensed on the surface) will be removed at this stage.

The offgas will then be used as a fuel in the stoves and Waste Heat Recovery system. The exhaust gas from these combustion processes will be directed to the FGD where sulphur dioxide will be removed. Some of the residual particulate material will be removed and any residual heavy metals will be dissolved in the FGD.

A mass balance for heavy metals in the Process is shown in Table 4.4.

Table 4.4
Mass Balance for Heavy Metals

Material	Zn (ppm)	Pb (ppm)	Cd (ppm)	Zn (kg/hr)	Pb (kg/hr)*	Cd (kg/hr)*
Coal	10	<5	<1	0.7	0.07	
Iron Ore	50	<5	<1	8.5	0.17	
Fluxes	30	<5	<1	0.5	0.02	

* based on an assumed 1ppm Pb no data for Cd in raw materials is currently available to the Proponent.

The PER (Section 7.3.9) provides estimates of the quantities of heavy metals in the Process. The flowsheet for the Process estimates that 19kg/hr of Zn, 1kg/hr of Pb and a few g/hr of Cd may be present in the gas leaving the Smelt Reduction Vessel. These estimates reflect that:

- approximately half of the offgas flow is passed through the Preheater, any heavy metals in that gas stream will condense on the ore particles and be recycled to the SRV; and
- the scrubber sludge is recycled back to the Process.

This will result in a recirculating load of heavy metals within the Process at levels higher than indicated in Table 4.4, as was reported in the PER. A portion of the sludge will be removed from the process to maintain the quantity of these metals in the system at a manageable level.

The removal efficiencies of the various scrubbing stages are not known with a high degree of certainty. However, the combination of the three stages will result in a high removal efficiency. For instance if a conservative estimate of 75% removal efficiency at each stage is assumed, an overall efficiency of 98.4% will be achieved. It is, however, believed that the first stage of wet scrubbing will achieve at least 90%, which, if the efficiency for each of the other two stages is 75%, will result in an overall efficiency of 99.4%, so an almost complete removal is expected. When applied to the proportion of the gas not passing into the Preheater the estimated emissions of Zn, Pb and Cd under the two scrubbing efficiency scenarios, 98.4% (and the anticipated 99.4%), is 330μg/Nm^3 (124μg/Nm^3) for Zn, 15μg/Nm^3 (6μg/Nm^3) for Pb and <1μg/Nm^3 for Cd. These are well below the US EPA emission standards for Large Waste Combustors.

4.3.6 Monitoring

Sampling of the offgas will be undertaken during the first year of the Stage 1 Plant operation to establish if there are any significant concentrations of heavy metals being emitted to the atmosphere. The results will be provided to the DEWCP. Future monitoring will depend upon the results of the initial monitoring. In the unlikely event that significant concentrations of heavy metals are being emitted then the Proponent will investigate the source of the emissions and will continue regular monitoring.

If monitoring confirms that there are no significant concentrations of heavy metals being emitted then sampling and analyses of the offgas for heavy metals would be undertaken less frequently, upon review of the results with the DEWCP.

The EPA Service Unit states that significant volumes of "fume" will be emitted from the pig caster area. Section 4.16 of the PER indicates that blowdown from the scrubbers (which will contain various contaminants) will be evaporated in the cooling of slag and pig iron. As this is done via direct contact it could have the potential to produce emissions of various compounds that may be toxic. Thus, information on the composition of the "fume" needs to be provided, including heavy metals and organic compounds.

During pig casting fume may be generated from the stream of pig iron as it is poured into the pig caster. This stream may react with oxygen in the air to form iron oxide. The majority of the fume will be generated in the tundish that distributes the metal to the moulds, this will have a fume extraction hood situated above it, extraction ducts will collect this fume and it will then be filtered in a baghouse (see Section 4.20.1 Table 4.7 of the PER). The moulds do not generate fume, the mould coating is a graphitic material that has been dried prior to the addition of the molten iron.

Section 3.5.1.2 and 4.21.1.2 of the PER provides details of the scrubber blowdown water referred to in section 4.16 of the PER. As explained the water that can be used for cooling the pig iron will have had any heavy metals removed. Organic compounds will be destroyed during the combustion of the offgas prior to the gas being scrubbed.

The contaminants that may still remain in the water will be predominately chlorides of sodium and potassium, which will precipitate out of the water as it is evaporated in cooling the pig iron. The fume from this cooling will be pure water vapour as steam.

The EPA Service Unit states that Section 4.3.1 of the PER indicates that during the commissioning period the Preheater offgas will be cleaned in a wet scrubber prior to being discharged to atmosphere. Please provide information on the composition of the offgas before and after the wet scrubbing stage. What is the likelihood of the offgas containing heavy metals and other organic compounds?

The commissioning of the Stage 1 Plant will be the first time that a Preheater and the HIsmelt Process have been combined. It is therefore likely that there will be technical issues to be overcome in commissioning both processes. As problems in one module could lead to problems in the other process it has been decided to commission the two processes separately, i.e. decoupled from one another with natural gas combustion replacing process offgas as the source of thermal energy. Once the two processes are operating to design specifications coupled operation will commence. The experience gained in commissioning the Stage 1 Plant will enable the Stage 2 Plant to be commissioned in coupled mode. Process start up after a shut down will be in coupled mode after the initial commissioning period.

During the commissioning period the Preheater will be simply used to dry and heat the iron ore fines using natural gas. The offgas from the Preheater during this phase of operation will contain moisture, CO_2, nitrogen, trace quantities of SO_2 and NO_x and fine iron ore particles. The flue gas composition is shown in Table 4.5.

The wet scrubber will remove the particulates, with the exit gas containing less than $50mg/Nm^3$ (note: the Preheater will be operating at a lower pressure during decoupled operation and that will result in a lower efficiency operation of the wet scrubber during this period). The wet scrubber may also remove some of the SO_2 and NO_x, though a conservative approach has been taken in the PER and no abatement in the wet scrubber has been assumed. There will be no heavy metals or organic compounds present in the offgas. The temperatures in the Preheater are not high enough to drive any heavy metals out of the iron ore particles where they are present as oxides at low trace levels. For Zn, Pb or Cd to be vapourised at the temperatures experienced in the Preheater the oxides must first be reduced to the metallic state, which will not occur under decoupled operation as the conditions at this time will be oxidising.

Table 4.5
Estimated Preheater Flue Gas Composition after Wet Scrubber During De-coupled Operation

Preheater Flue	Units
152.1	kNm3/h
73	deg C
0	bar g
8.3	% O_2
0.0	% CO
4.6	% CO_2
0.0	% H_2
30.5	% H_2O
56.6	% N_2
0.0	% CH_4
0.0	ppm H_2S
15	ppm SO_2

The relatively high residence time at temperatures above 850°C within the Preheater will ensure complete destruction of the natural gas. The Proponent believes there is a very low probability of the iron ore being contaminated with organic material. The size of stockpiles planned for the Plant ensures a high turnover of ore, therefore limiting the opportunity for colonisation by plant species. The coal will be reclaimed from the stockpiles using a different set of conveyors to those used for ore, thus limiting the chance of cross contamination of the ore feed to the Preheater with coal.

It should also be noted that the operation of the Preheater with natural gas represents a higher cost scenario than operation with process offgas, there is therefore a strong incentive to keep this commissioning period as short as possible.

The Town of Kwinana requested that the Council be consulted prior to any downgrading of monitoring.

Any downgrading of monitoring programmes for heavy metals needs to be justified and with consultation with the community.

A discussion on the Process and the potential for the emission of heavy metals in the gas stream is presented in Appendix A and the PER (Section 7.3.9) which shows that the metals will be dissolved in the scrubber water. It is considered unlikely that the Plant will generate and emit heavy metals into the atmosphere. To ensure that fact the Proponent has committed to sample and analyse the offgas for the presence of heavy metals during the first year of operation. The results of the monitoring will be provided to the DEWCP and can also be made publicly available on the HIsmelt web site.

The monitoring programme for heavy metals to be undertaken following the first year's operation will depend upon the results of the initial monitoring and following review with the DEWCP. If monitoring confirms that there are no significant concentrations of heavy metals being emitted then the frequency of the monitoring may be reduced, but only after consultation and agreement with the authorities.

4.3.7 Particulates

The Town of Kwinana requested evidence to confirm that the management of airborne particulates from the Plant does in fact represent Best Available Technology.

Wet scrubbers will be incorporated on both the Preheater and main offgas line to clean the process gas as discussed in Section 7.3.4.3 of the PER. This type of scrubber is considered Best Available Technology by the European Commission in its *Integrated Pollution Prevention and Control (IPPC) – Best Available Techniques Reference Document on the Production of Iron and Steel.* March 2000 (Section 7 EPI pp200-201.)

Two bag filters will also be incorporated in the Plant design to capture fume and remove particulates prior to release to the atmosphere as discussed in Section 7.3.4.3. These bag filters are considered Best Available Technology in Europe by the European Commission in the above document.

The Town of Kwinana stated that the Proponent should commit to comply with the EPP standards for particulates.

The Proponent will comply with the EPP standards and limits for particulates as discussed in the PER Sections 5.3 and 7.3 and see Section 4.4.1 of this report. Table 7.5 of the PER presents the predicted maximum concentrations for particulates together with the percentage of the EPP limits. The table shows that for Total Suspended Particulates the predicted maximum concentrations are up to 16.7% of the criteria for EPP Area A (Industrial Zone) decreasing to 2.5% of the criteria in Area C (Residential Zone).

The EPA Service Unit states that the first dot point in Section 7.3.4.3 of the PER indicates that the wet scrubbers on the Preheater and the main offgas lines are considered to be best available technology by the European Commission (European Commission, 2000), and that they will clean the process gas to ensure that the particulate level is less than 5mg/Nm^3. Can the proponent please address the following concerns:

1. *What is the averaging time for the quoted value of 5mg/Nm^3?*
2. *Is the quoted level of 5mg/Nm^3 a claim made by the manufacturer of the wet scrubbers? and*
3. *Is the statement that this type of scrubber "has demonstrated to be very and reliable and to consistently be below the 5mg/Nm^3 output level", also a claim made by the manufacturer of the wet scrubbers? If not, can the proponent please clarify the source of this information?*

1. The 5mg/Nm^3 is the maximum level emitted by the wet scrubbers that is expected to be achieved over a substantial period of time in a well maintained and operated installation or process using those techniques. The averaging time will depend upon the duration of sampling, which is likely to be around 30 minutes.

2. The level of 5mg/Nm^3 is the figure quoted by manufacturers (there are two major suppliers of this type of equipment to the iron and steel industry), and consequently is the minimum performance level being written into tender specifications. This specification is to be backed up by process guarantees (subject to operating parameters, such as pressure drop, being within specification).

3. The statement, while no doubt endorsed by the manufacturers, reflects the fact that this type of scrubber is installed on most currently operating blast furnaces throughout the world (**Refs. 'The making, shaping and treating of steel 11th Edition - Ironmaking Volume, Section 9.4.2', Kvaerner Engineering and Construction experience in blast furnace design and maintenance, Proponents experience within the iron and steel industry**). For example, two of the Proponent's personnel visited the Ispat Inland No. 7 Blast Furnace, located near Chicago, USA, in August 2000 while performing a Detailed Feasibility Study for the installation of a HIsmelt Plant in the US. The associated wet scrubber had been in operation since 1985 and had demonstrated very high availability (>95%) and the exit gas particulate concentration was less than 5mg/Nm^3. This type of scrubber was installed on the Port Kembla No. 6 Blast Furnace, one of the more recently installed blast furnaces.

The EPA Service Unit states that the third dot point in Section 7.3.4.3 of the PER indicates that particulate emissions will be managed because "Particulate emissions from the main stack will average 0.17g/s". Table 4.9 in the PER indicates that the particulate emission concentration from the main stack under normal operating conditions will be 1.8mg/Nm^3. Can the Proponent please address the following concerns:

(1) What is the averaging time for the quoted particulate emission concentration of 1.8mg/Nm^3 from the main stack?; and

(2) Does the quoted concentration level of 1.8mg/Nm^3 represent best practice levels when compared to relevant European Commission (EC) and US EPA standards for particulate emissions from iron and steel production plants and large combustion plants etc? [please provide appropriate references]

1. The 1.8mg/Nm^3 is the maximum level emitted from the main stack that is expected to be achieved over a substantial period of time in a well maintained and operated installation or process using those techniques. The averaging period will depend upon the duration of sampling , which is likely to be around 30 minutes.

2. It should be noted that the offgas system for the Plant will comprise the following steps:

   - Particulate removal by wet scrubbing, resulting in a fuel gas stream with a particulate content <5mg/Nm^3;
   - Further cooling of the offgas in a packed tower by water sprays.
   - Combustion of the offgas as a fuel in the Hot Blast Stoves and Waste Heat Recovery unit with the exhaust gas from both processes passing through the FGD prior to release to atmosphere.

   The combustion air required for combustion of the gas will result in a substantially greater exhaust gas volume. As the combustion of CO and hydrogen does not produce any particulates the particulate concentration of the exhaust gas will be lower than in the fuel gas (though the mass flow of particulates remains virtually unchanged).

   In the FGD the SO_2 reacts with calcium oxide to produce calcium sulphite. In order to oxidise the calcium sulphite to gypsum a stream of compressed air will be injected into the FGD sump. This air will contribute adds to the volume of exhaust gas thereby further diluting the particulate concentration.

   Hence, the 5mg/Nm^3 concentration in the fuel gas stream corresponds to the 1.8mg/Nm^3 estimated emission from the main stack. This emission level is much lower than the EC and US EPA standards for particulates quoted in the submission. It should be noted that the offgas cooling and FGD processes may result in additional particulate scrubbing, however, this has not been included in the emission estimate.

The EPA Service Unit states that the fourth dot point in Section 7.3.4.3 of the PER indicates that "Particulate emissions from the other stacks will be designed to be less than 50mg/Nm³", and "Greater than 95% of the particulates will be less than 1μm". Can the Proponent please provide the following information:

(1) What is the size of the particulates in the remaining 5% of the emissions from the "other stacks"?;

(2) What is the averaging time for the quoted particulate emission concentration of 50mg/Nm³ from the "other stacks"?; and

(3) Does the quoted level of 50mg/Nm³ represent best practice levels when compared to relevant European Commission (EC) and US EPA standards for particulate emissions from iron and steel production plants and large combustion plants etc? [please provide appropriate references]

1. The Air Quality Assessment Report, Appendix C of the PER, Section 8.1 states that 'As the particulates are from combustion products and from scrubber systems, the majority will be well below 10μm and as such have been modelled assuming that particle settling is not important'. Thus it is anticipated that the 5% estimated to be >1μm will be between 1 and 10μm with the majority at the low end of the range as the particulates will have had to pass through the weave of the fabric filter for them to be in the exhaust stream.

2. The 50mg/Nm³ is the maximum level emitted from the other stacks that is expected to be achieved over a substantial period of time in a well maintained and operated installation or process using those techniques. The averaging period will depend upon the duration of sampling, which is likely to be around 30 minutes.

3. See responses below on best practice technology.

The EPA Service Unit states that the fifth dot point in Section 7.3.4.3 of the PER indicates that "The fume will be captured in two bag filter modules, both of which will be designed to clean the gas to particulate concentrations of less than 50mg/Nm³ prior to release to atmosphere, which is considered Best Available Technology in Europe (European Commission, 2000)." Can the Proponent please clarify what the averaging time is for the quoted particulate emission concentration of 50mg/Nm³.

The 50mg/Nm³ is the maximum level emitted from the bag filters that is expected to be achieved over a substantial period of time in a well maintained and operated installation or process using those techniques. The averaging period will depend upon the duration of sampling , which is likely to be around 30 minutes.

The EPA Service Unit notes that Item 7 in Section 7.4 on page 212 of the above referenced document indicates that dust emission concentrations of 1 to 15mg/Nm³ can be achieved with fabric filtration (i.e. bag filters) when collecting fume from operations dealing with molten metals

The EPA Service Unit states that Table 4.9 in the PER indicates that particulate emission concentrations from the Cast House Extraction No. 1 stack and the Pig Caster Fume Extraction No. 2 stack under normal operations will be 30mg/Nm^3 and 20mg/Nm^3 respectively. These values appear to be well above best practice levels. Therefore, whilst bag filter modules may be considered to be best available technology, the EPA Service Unit considers that they should be designed to emit particulate emissions at best practice levels (i.e. 1 to 15mg/Nm^3). In view of the above, is the proponent prepared to make an additional commitment to design the bag filter modules so that they achieve a particulate emission concentration level of 1 to 15mg/Nm^3? If not, why not?

The EPA Service Unit states that the fifth dot point in Section 7.3.4.3 of the PER indicates that "Any storage bins that are filled by the pneumatic conveying of solid materials, such as the ground coal storage bin and the three lime bins, will be vented through bag filter cleaning systems designed to clean the exhaust gas stream to particulate concentrations of less than 50mg/Nm^3 prior to release to the atmosphere." Can the proponent please clarify what the averaging time is for the quoted particulate emission concentration value of 50mg/Nm^3.

The EPA Service Unit states that Table 4.9 in the PER indicates that particulate emission concentrations from the Coal Mill stack will be 15mg/Nm^3 under normal operating conditions. Can the proponent please provide additional information (with suitable references) in regard to whether the bag filter cleaning system that will be used is considered to be best available technology for the above application when compared to relevant European Commission (EC) and US EPA standards for particulate emissions from iron and steel production plants and large combustion plants etc?

All of the above comments and questions relate to the specifications of the bag filters, the particulate emission levels from the stacks, and the standards for particulate emissions. To avoid duplication the Proponent has prepared the following response, which addresses all of these comment and questions.

The engineering specifications being submitted by the Proponent to potential vendors of bag filter equipment include the specification that exhaust gas should have a particulate content <10mg/Nm^3. However, at the time of the PER preparation the Proponent was uncertain as to whether this could be achieved. Hence, a more conservative estimate was used in the PER.

Information provided at an Air Pollution Control Equipment Manufacturers Association of Australia (APCEMA) seminar in July, 2000 suggested that as a general rule 'final emissions from a well designed baghouse from a reputable supplier will be less than 50mg/Nm^3. However, for most applications the presentation stated that 'dust emissions would be anticipated to be less than 20mg/Nm^3'. (**Ref. 'Selection Criteria for Fabric Filter Baghouse and Baghouses', Peter Dearle, APCEMA Workshop, Perth July 2000**). Without detailed design information available for the Plant at the time of PER preparation the higher number (worst case) was used for particulate modeling. However, it is the Proponent's intention to achieve final emissions that are consistent with Best Achievable Technology, which is less than 15mg/Nm^3. The Proponent will incorporate bag filters that have design specifications for a particulate emission limit of less than 15mg/Nm^3.

The Town of Kwinana requests that the Proponent measure/ monitor particulates quarterly rather than every six months.

The Proponent has committed to measure the particulate emissions on a six monthly basis, however, the Proponent will increase the frequency of monitoring to quarterly if the DEWCP consider it appropriate.

Continuous particulate monitoring should be considered.

Most continuous particulate monitors rely on the attenuation of a light beam by particles in the gas stream. The calibration of such units is based on a correlation with physical samples extracted from the duct. The parameters that can affect the calibration are particle size and shape.

As the main Process stacks, located after the FGD, will be 'wet stacks' (i.e. saturated with water vapour at 75°C) continuous particulate monitors that rely on the attenuation of a beam of light shining across a duct cannot be used (Environmental Process Control (Pty) Ltd, pers comm. 2001).

For the bag filter stacks, it is the Proponent's experience that the filters work as designed unless there is a problem with the bags. Stack sampling on a routine basis will be sufficient to confirm that the emission levels are as expected. However, the Proponent has specified that the bag filter modules to be supplied for the Plant are to be fitted with broken bag detection instrumentation to provide the Proponent with an early indication of any problem so that corrective action may be taken. The modular nature of the bag filters will allow the unit with the broken bag(s) to be taken off line for the fitting of a new bag(s).

The Town of Kwinana requested clarification on the size of particles to be included in the proposed dust monitoring programme.

$PM_{2.5}$ should also be monitored as world recognised research indicates that it is responsible for serious health problems.

As stated in Section 7.3.4.4 of the PER, the particulate emissions will be monitored and a size distribution of particulates will be undertaken in the sampling programme to determine the percentage of TSP, PM_{10} and $PM_{2.5}$.

4.3.8 Dioxins, Furans, PAHs, POPs etc

The EPA Service Unit states that minor emissions of Dioxins, Furans, polyaromatic hydrocarbons (PAHs), volatile organic compound (VOCs), and other persistent organic pollutants (POPs) from the proposed Plant would be of concern to the public. Can the Proponent please:

- *estimate the emission rate / quantity of each species;*
- *show how the emissions are calculated (include references); and*
- *compare the anticipated emissions with best practice limits?*

The Town of Kwinana requested details on the results of stack testing at the HRDF and if any air toxics were detected and at what concentrations.

The Town of Kwinana stated that there appears to be no intention to monitor PAHs and VOCs.

The use of coal as the reductant and energy source has the potential to result in emissions of VOC's, PAH's and other POP's (which include Dioxins and Furans as discussed in section 7.3.8 and Appendix G of the PER). These compounds have the potential to contribute to photochemical smog (such as from VOC's) and to cause health impacts (such as from VOC's, PAH's and POP's). An Assessment of the Human Health Issues of these substances has been prepared by the Proponent and is presented on Appendix A.

The offgas from the HRDF was sampled and analysed for Dioxins and Furans as discussed in Appendix G of the PER. The offgas was sampled just after the bag filter with a maximum level of 0.09ng/Nm^3 in terms of toxic equivalent (I-TEQ) being found. The gas was then combusted at a temperature above 900°C, either in the hot blast stoves or in a combustion chamber at the base of the main stack, prior to being released to the atmosphere, therefore, it is unlikely that Dioxins and Furans would be present in the gas being emitted to the atmosphere (a temperature above 850°C is deemed necessary for the destruction of these compounds (European Parliament and Council 2000)). As any carbonaceous particles in the gas stream were ultrafine (having passed through a bag filter) they would be destroyed in the combustion process and the high exit temperature (>600°C at the top of the stack) resulted in the probability of de novo synthesis of dioxins and furans in the exhaust stream being very low.

The offgas from the HRDF was sampled and analysed for VOC's on a number of occasions, and specifically for PAH's on one occasion. The gas was sampled after being cleaned in a bag filter and prior to combustion. The results indicated that levels of VOC's were in the very low parts per billion range and PAH's in the gas totalled 4.4µg/Nm^3. These compounds were then subjected to high temperature combustion (>900°C) prior to release to the atmosphere. This combustion stage would have resulted in the destruction of these compounds in the offgas ensuring there were no emissions to atmosphere.

The manner in which the HIsmelt Process utilises coal will result in a very low potential for the generation of the above listed compounds. The coal will be injected at a high velocity into a deep bath of molten iron, the carbon will be dissolved in the iron and the mineral components (as ash) will report to the slag. Coal volatiles, which evolve due to pyrolysis, together with carbon monoxide produced by the reaction of iron ore with the dissolved carbon will be partially combusted by reacting with the Hot Air Blast in the furnace top space.

The high temperature (1450 - 2600°C) in the top space will break down any organic compounds that survive the passage through the molten iron and slag, into carbon monoxide and hydrogen. The manner in which the HIsmelt Process utilises coal is shown in Figure 2.

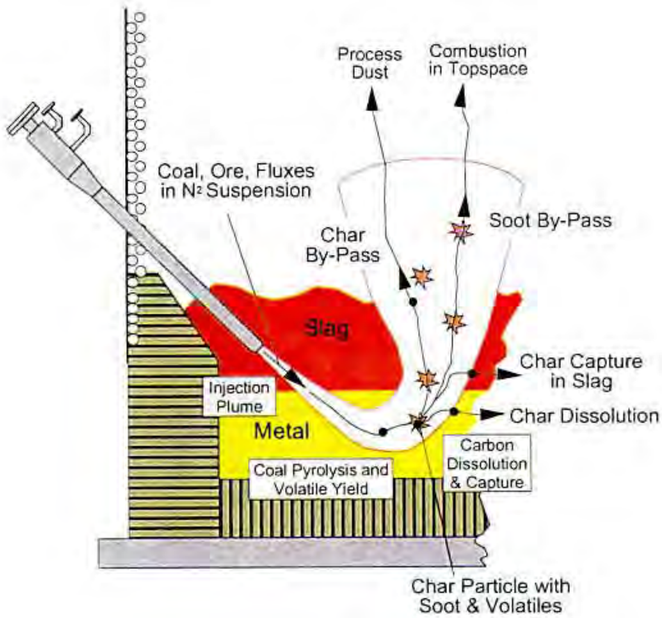


Figure 2 Coal Movements through the HIsmelt Process

The offgas will then be cooled to 1000°C prior to the stream being split into two, with half being passed to the Preheater whilst the remainder will be cleaned in the wet scrubber. The gas from the wet scrubber will then be used as a fuel in the hot blast stoves and the WHR. The Preheater offgas will be cleaned in a wet scrubber and then used as a fuel in the WHR. The combustion of the offgas will destroy any VOC's, PAH's etc that have managed to survive the high temperatures in the SRV resulting in no significant emissions of these pollutants to the atmosphere.

Sampling of the offgas will be undertaken during the first year of the Stage 1 Plant's operation to establish if there are any VOC's, PAH's or other POP's present. Monitoring results will be provided to the DEWCP. Future monitoring will depend upon the results of the initial monitoring. In the improbable event that those species are being generated by the Process and emitted to the atmosphere the Proponent will investigate the source of the emissions and will continue regular monitoring.

The EPA Service Unit states that Appendix G of the PER indicated that monitoring for Dioxins at the HRDF showed levels of 0.09ng/m^3 I-TEQ after the bag filter. The Proponent believes that the scrubbing technology employed in the proposed plant will prevent dioxins from forming. The Proponent has made a commitment to monitor for the presence of dioxins and furans during the first year of operation. Section 7.3.8 of the PER indicates that, in the unlikely event that Dioxins and Furans are being generated by the HIsmelt process and emitted to atmosphere, the Proponent will investigate the source of emissions and will continue regular monitoring. What are the contingency measures that can be employed by the Proponent if Dioxins and Furans emissions cannot be prevented?

The Proponent has designed the Process flowsheet to prevent the generation of Dioxins and Furans, rather than to implement 'end of pipe' solutions such as the injection of activated carbon followed by collection in a scrubber or fabric bag filter. The end of pipe solutions do not destroy the Dioxins and Furans, rather they transfer the problem from an air emission to a solid waste disposal problem.. In order to confirm that the process flowsheet proposed for the Plant has a low potential for the generation and emission of Dioxins and Furans, HIsmelt commissioned Sinclair Knight Mertz to undertake a review of the HIsmelt process flowsheet. The study concluded that the potential for the emission of Dioxins and Furans from the Plant would be low and similar to that expected from a natural gas burning utility boiler. A copy of the report is included as an Attachment to Appendix A.

It should be noted that if Dioxins and Furans are emitted by the HIsmelt Process at levels above the most stringent standards (0.1ng/Nm^3 I_TEQ) then the Process will not meet global requirements as a replacement for current integrated iron making technology. Should any Dioxins and Furans be detected the Proponent commits to investigating the cause of the generation and emission of the Dioxins and Furans and implementing preventative measures. If it proves impossible to prevent emissions of Dioxins and Furans, that exceed the most stringent standard, by modifications to the Process or equipment then the Plant would then be closed.

The Town of Kwinana states that Council, Industry and the community should be aware of the levels of emissions of Dioxins, Furans, PAHs and VOCs. The EPA should facilitate a study to determine these levels.

The current levels of Dioxins, Furans, PAHs and VOCs in the Kwinana air shed should be measured.

There is concern about the levels of air pollutants in the Kwinana area due to emissions from industry. The Proponent would support a study to be undertaken by the Government and/or the Kwinana Industries Council to determine the levels of air pollutants being emitted by Kwinana industries. The parameters measured could include all of these substances.

The City of Rockingham recommends that the Proponent should report to DEWCP immediately any incidence of Dioxins and Furans detected and the reasons for the release.

It should be noted that it is not currently possible to continuously monitor for Dioxins and Furans in the exhaust gas stream. Sampling of stacks for Dioxins and Furans is a specialised field that can only be performed by a small number of companies within Australia. The analysis of the samples collected is a complex and very expensive procedure. The Proponent plans to undertake sampling and analysis at a frequency that is sufficient to provide data to prove that the Plant is not emitting these compounds. As there is little point in continuing to sample and analyse for these compounds if they are not present, monitoring will then be undertaken periodically to ensure that the situation has not changed.

The Proponent has made a commitment to provide the DEWCP with the results of all such monitoring. As the Process is not expected to generate and emit Dioxins and Furans the Proponent will investigate any incidences where emissions of these compounds occur.

The Town of Kwinana requested that it be consulted on any downgrading of monitoring programmes for Dioxins, Furans and heavy metals. Any downgrading needs to be justified.

The community needs to be consulted on any downgrading of monitoring.

The City of Rockingham stated that on going monitoring of Dioxins and Furans should be required to ensure that the process technology is working effectively to remove any Dioxins and Furans produced.

A discussion on the process and the potential for the emission of Dioxins and Furans in the gas stream is presented in Section 7.3.8 and Appendix G of the PER, and in Appendix A of this report. The offgas handling system for the Plant was selected to ensure that no Dioxins and Furans would be emitted. To confirm this, the Proponent has committed to sample and analyse the offgas for the presence of Dioxins and Furans during the first year of operation. The results of the monitoring will be provided to the DEWCP and can also be made publicly available on the HIsmelt web site.

The monitoring programme for Dioxins and Furans to be undertaken following the first year's operation will depend upon the results of the initial monitoring and following review with the DEWCP. If monitoring confirms that there are no Dioxins and Furans being generated by the Process and emitted then the frequency of the monitoring may be reduced, but only after consultation and agreement with the authorities.

A risk assessment and more information on the possible Dioxin/ Furan emissions, such as in cases of cooling system malfunction or incorrect operation should be provided.

The components of the Process that will ensure that there are no Dioxins and Furans emitted are also essential for the safe operation of the Plant. The failure of any module will therefore result in a shut down of the Process until the fault is rectified.

The major piece of equipment designed to prevent emissions of Dioxins and Furans will be the high temperature wet scrubber. This scrubber quenches the offgas from a temperature of ~1000°C to 90°C, removes the particulates and controls the SRV pressure. A failure of this module would result in hot offgas passing into steel pipes that are not designed for high temperature operation, which could cause an uncontrolled release of flammable toxic gas. The Plant interlocks will shut down the Process immediately a fault in the wet scrubber is detected.

Similar interlocks will be incorporated into all components of the offgas system due to the hazards associated with equipment failures. Therefore there is no possibility of an equipment failure allowing uncontrolled releases of any pollutants, including Dioxins and Furans.

4.3.9 Odour

The Town of Kwinana states that throughout the life of the HRDF, neither DEWCP nor the Council have received complaints resulting from odour or any other site impacts.

What is the potential impact of odour on recreational users of the Sound?

The issue and management relating to potential odours from the Plant are addressed in Section 7.3.10 of the PER. The main potential for odour is from the generation of hydrogen sulphide during the cooling of the slag as discussed in Section 7.3.10 of the PER. This will be managed on site and there will not be any impact of odour on recreational users of Cockburn Sound.

4.4 DUST

4.4.1 HIsmelt Site

The EPA Service Unit stated that in view of the fact that:

(a) the various measures implemented at the Port of Esperance to control dust from iron ore stockpiles, such as enclosing the stockpiles in a shed, are considered to represent "state of the art" technology (Dames & Moore, 1999), and have been included as a case study in Environment Australia's "Best Practice Environmental Management in Mining - Dust Control" booklet (Environment Australia, 1998); and
(b) the proposed Kwinana Export Facility will employ the various measures implemented at the Port of Esperance to control dust from iron ore stockpiles, including sheds;

the Proponent needs to provide detailed justification for not implementing the same measures, at the proposed Plant.

The EPA Service Unit asks "Is the Proponent willing to demonstrate good corporate citizenship through the application of best available technology and best management practices, and make an additional commitment to implement equivalent best available technology (in particular, enclosing the iron ore and coal stockpiles in sheds) in order to control fugitive dust emissions from the proposed Plant? If not, why not?"

The DEWCP (Kwinana) and the Cockburn Sound Management Council requested that there is a need to demonstrate that a fully enclosed fine materials storage system is not required at the proposed HIsmelt Plant.

In relation to the Proponent demonstrating "good corporate citizenship" Rio Tinto, of which HIsmelt is a Business Unit, states in its document titled " The way we work – Our statement of business practice":

> *" Rio Tinto is a world leader in finding, mining and processing the earth's mineral resources.*
>
> *In order to deliver superior returns to our shareholders over many years, we take a long term and responsible approach to exploring for first class orebodies and to developing large, efficient operations capable of sustaining competitive advantage. In this way, we help to meet the global need for minerals and metals which contribute to essential improvements in well being, as well as making a direct contribution to economic development and employment in those countries where we invest.*
>
> *Wherever we operate, we work as closely as possible with our hosts, respecting laws and customs, minimising adverse impacts, and ensuring transfer of benefits and enhancement of opportunities. We believe that our competitiveness and future success depend not only on our employees and the quality and diversity of our assets but also on our record as good neighbours and partners around the world.*
>
> *Accordingly, we set ourselves high environmental and community standards. Our commitment to health, safety and the enhancement of the skills and capabilities of our employees is second to none in mining. We seek to make lasting contributions to local communities and to be sensitive to their culture and way of life."*

The Proponent will implement all reasonable and practicable measures to prevent the dust emissions from the site, as required under Section 51(2) of the *Environmental Protection Act,1986.* Practicable is defined in the Act as meaning "reasonably practicable having regard to among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge". A discussion on the Proponent's investigation on dust management measures and the proposed management at the site is provided below.

The Proponent acknowledges that storage of iron ore for export at the Esperance Port is within sheds. This was a result of public concern on the potential impacts on tourism, the pristine nature of the white sand beaches and the close proximity to residences (150m and 300m from the port facilities) and its reputation as a place of unique beauty. The Proponent is also aware of the proposal by Koolyanobbing Iron Ore Pty Ltd in 1999 to establish an Iron Ore Export Facility near the Kwinana Bulk Cargo Jetty, which included similar facilities to those at Esperance (Dames & Moore, 1999).

The storage of coal inside large sheds will result in the shed being designated a hazardous area as defined by AS2430, due to the potential for accumulation of a combustible dust. This would then require all electrical equipment used in the shed to comply with AS2381.10 (1995), which significantly increases the capital cost. Mobile equipment for use within this shed would also have to meet stringent safety specifications, again resulting in a higher capital cost. Some coals are susceptible to spontaneous combustion, which can lead to the release of toxic and/or flammable gases. This reinforces the hazardous area classification.

The Proponent is also aware that the current best practice for dust suppression from stockpiles is the use of water sprays as is discussed in of the Best Practice Environmental Management in Mining - Dust Control (Environment Australia, 1998). Water sprays are used for dust suppression on the iron ore stockpiles at BHP Billiton's operation at Port Hedland as cited in Case Study 2 in the above Dust Control Best Practice booklet.

A Dust Management Plan for the site operations will be prepared and submitted to DEWCP prior to commissioning. This Management Plan will specify the management for dust suppression from the stockpiles and transfer operations.

The Integrated Pollution Prevention and Control (IPPC) Sector Guidance Note S2.01 (Environment Agency, 2001). provides Best Available Technology (BAT) for raw materials handling. The document states that the "BAT for the prevention of dust releases during handling of bulk materials is the appropriate combination of:

- orientation of long stockpiles in the direction of the prevailing wind;
- installing wind barriers or using terrain to provide shelter;
- controlling the moisture content of the material delivered;
- careful attention to procedures to avoid unnecessary handling of materials and long unenclosed drops;
- adequate containment on conveyors and in hoppers etc;
- the use of dust suppression water sprays with additives such as latex, where appropriate;
- rigorous maintenance standards for equipment;
- high standards of housekeeping, in particular the cleaning and damping of roads;
- use of mobile and stationary vacuum cleaning equipment; and
- dust suppression or dust extraction and bag filter cleaning plant to abate sources of significant dust generation."

The above document also states that "The following are normally considered to be the BAT for material delivery, storage and reclamation activities:

- manage stockpile levels so that the drop from the feed chute to the stockpile is minimised, and if fugitive releases are evident then water sprays used to suppress fugitive dust;
- unloading hoppers for dusty materials should be totally enclosed in a building equipped with filtered air extraction or the hoppers should be fitted with dust baffles and the unloading grids should be coupled to a dust extraction and cleaning system; and
- water sprays (preferably using recycled water) should be used for dust suppression."

Section 7.5.3 of the PER outlines the dust management measures to be implemented at the site. These measures together with any additional best management practices for dust suppression identified by the Proponent will ensure that any dust generated from the Project operations does not cause an adverse impact.

Iron ore and coal were stockpiled as feed materials for the HRDF. Remnants of the stockpiles still remain on the site. The Proponent found that dust generation from the stockpiles was not an issue. Water was applied to the stockpiles, which resulted in a crust forming on the surface which prevented dust generation.

The Proponent has investigated the World's Best Practice dust suppression measures for the transfer and storage of iron ore and coal, in particular for import operations. During April 2000 the Proponent inspected the following three Japanese operations to determine the current best practice for dust management of unloading and the stockpiling of iron ore and coal at near city locations:

- Kobe Steel in Kakogawa.
- Sumitomo Metal Industries in Wakayama.
- Nippon Steel in Oita.

The general findings were that all steel companies throughout Japan use water sprays for dust suppression for the unloading, stockpiling, reclaiming and handling of iron ore and coal in the stockpile area. Water is also used for dust suppression in areas where sinter, coke and slag is handled.

Dust management commences at the ship to ensure that the raw material in the hold is moistened and then water sprays are used at various handling and transfer points to ensure that there are no visible dust emissions. Unloading at all sites was undertaken using "clam shell" unloaders. There is a general consensus around the operations that when the wind velocity reaches 16-20 m/sec then the unloading will cease.

Large automatic "irrigation type" water sprays are used to moisten the surface of the stockpiles. The sprays are controlled to be activated for a designated time at specific intervals which are determined by the season, time of day and wind speed.

Kobe Steel – Kakogawa

The Kakogawa plant is a typical Japanese integrated steel plant. Raw materials are unloaded on the east side of a (semi) island and pass through the manufacturing facilities to the product loading facilities on the west side of the island. Ore storage capacity at the plant site is around 2.3 Million tonnes.

Water is sprayed into the receiving hopper of the unloaders whilst the ore is being unloaded from the ships.

At the time of the inspection iron ore from Western Australia was being unloaded. Ore can be unloaded at a rate of 40,000 tonnes per day. There are six conventional grab unloaders (see Plate 4.1) at Kakagawa. Deflector plates are positioned to prevent spillage into the sea as shown on Plate 4.1.

Plate 4.1 Grab Unloader at Kakogawa
(the deflector plate to catch spillage is shown directly below the grab.

Plate 4.2 Grab Discharging Lump Ore into Receival Hopper at Kakogawa (water spray can be seen at left of grab).

The storage yards are equipped with 145 water canons to allow coverage of the stockpiles. The sprays have a 50m spread and are activated every four hours, with the frequency increased if the wind speed reaches above 16m/sec (see Plate 4.3). A chemical dust suppressant is sometimes applied, using water tankers, to the surface of the stockpiles when the material is to be stored for longer than two months. Water is collected from the stockpile area and reused.

Plate 4.3 Water Sprays on Ore Stockpile at Kakogawa

Sumitomo – Wakayama

The Sumitomo plant is situated on the coast to the immediate south of the city of Wakayama, which has a population of 390,000. The raw material storage yards run east-west immediately behind the wharf area. The closest residence to the plant is around 250m from the site boundary. There is a green belt around the boundary of the plant.

Raw materials are unloaded predominantly using grab unloaders that can unload at rate of 700tph. A continuous unloader is available that has a discharge rate of 1800tph but is considered a high maintenance item and is more vulnerable to weather conditions such as swell and wind than the grab unloaders.

During unloading water is added to the receival hopper and at transfer points along the conveyor. Visual monitoring is used to adjust the quantity of water sprayed.

Water is also used for dust suppression on the stockpiles (see Plate 4.4). Sprays are used on the working face as the material is reclaimed and also at the transfer points. The frequency and activation of each spray is scheduled depending on the season with summer requiring the higher frequency as the prevailing winds blow towards the city. A dust suppressant is applied to the coal stockpiles.

Plate 4.4 Water Sprays on Ore Stockpiles at Wakayama

An anemometer is used to control the activation of the water sprays and wind data are relayed to the control room. Each spray is activated for a one minute period. If the wind speed is above 10m/sec then the reclaiming of coal ceases, and if the wind speed is above 16m/sec then the unloading ceases.

Qualitative static sampling is undertaken, using fly-paper type strips onto which airborne dust sticks, to monitor dust emissions. This, regular inspection allows a qualitative assessment of dust levels. There are ten monitoring stations situated throughout the city, all funded by Sumitomo. Dust samples are analysed for composition, in addition to the mass collected, so that the origin of the dust can be identified.

Nippon Steel – Oita

The Nippon Steel Works is located in close proximity to the city as shown on the photo presented as Figure 3. The raw materials are unloaded, using grab unloaders, on a 600m long berth situated 400m from the shore. Water is sprayed into the ship's hold and mixed using the grab. Deflector plates are used to prevent spillage into the sea. The grab discharges the material into a receival hopper as shown on Plate 4.5. Unloading is ceased if the wind speed exceeds 20m/sec. Wind speeds of greater than 10m/sec are common during winter.

Plate 4.5 Grab Discharging Coal into Receival Hopper at Oita

There are nine ore stockpiles and five coal stockpiles at the plant site. Water sprays are used for dust control on the stockpile area as shown on Plate 4.6. A polymer based dust suppressant is applied to the coal stockpiles which helps to form a crust that prevents dust generation and the penetration of water from the stockpile sprays.

Plate 4.6 Water Sprays on Ore Stockpiles at Oita

Static dust samplers are installed at various locations throughout residential areas and the data are reviewed on a monthly basis. Regular contact is maintained with the community groups on the results of the dust monitoring and dust issues.

HIsmelt®

Commercial HIsmelt Plant
RESPONSE TO SUBMISSIONS

AERIAL PHOTOGRAPH - OITA

Figure 3

PINPOINT CARTOGRAPHICS (08) 9277 7763 figure2.dgn

Implications of Investigations for HIsmelt

The Proponent will incorporate similar water spray systems for dust suppression, as is used at Japanese plants that have very large stockpiles and cities nearby, on the iron ore and coal stockpiles at the Kwinana site. The system will include:

- closed circuit TV cameras that monitor operations and relevant meteorological measuring devices;
- water spray reticulation system;
- collection, cleaning and reuse of water;
- PLC which is programmed for various meteorological conditions that will automatically activate the water sprays; and
- dust monitors.

The Proponent expects that the proposed dust suppression measures for stockpile management, discussed in the PER and above, will result in negligible fugitive dust. The Proponent will monitor and measure fugitive dust emissions on the site. If the dust levels are found to exceed the EPP limits, and are of concern then the Proponent will analyse the dust collected in the gauges to determine the source of the fugitive dust. If it is found that the majority of the dust collected is from the stockpiles on the HIsmelt site then the Proponent will investigate additional dust management measures.

The DEWCP (Kwinana) and the Cockburn Sound Management Council stated that no estimate has been provided in regard to the amount of dust generated from the stockpiling of iron ore and coal. It is therefore not possible to determine whether the use of water sprays will be sufficient to prevent fugitive dust emissions.

As dust suppression system similar to those described above will be implemented at the site with a target of zero dust generation from the stockpiles. Dust monitors will be installed around the site to measure dust in the ambient air as discussed in the Response above.

The City of Cockburn requested that contact details be provided to facilitate appropriate reporting of dust complaints.

The contact details for environmental matters for HIsmelt Operations is:

Colin Prickett – Manager - Environmental
Phone 94370674
Fax 94370601
e-mail colin.prickett@hismelt.riotinto.com.au

The Town of Kwinana states that dust from the feedstock stockpiles could also be a nuisance if not managed properly. The Proponent should address this issue as part of the Environmental Management Plan.

A Dust Management Plan should be prepared for the site that addresses the possible use of sprinklers on conveyors and stockpile materials.

As stated in Section 7.5.3 of the PER and to which the Proponent has made a formal commitment, a Dust Management Plan will be prepared and submitted to the DEWCP prior to commissioning. The Dust Management Plan will include the management measures as listed in Section 7.5.3 of the PER. These include the use of atomising water sprays at transfer points, dump hoppers and conveyor discharge points, and the use of water sprays on stockpiles such as a network of high pressure water canons.

4.4.2 Port Unloading and Transfer Operations

The Cockburn Sound Management Council requested an estimate of the dust to be generated from the unloading of ore and coal. Some description of any dust plume, which may arise from the unloading operations, should be provided.

The objective is to not generate dust during the unloading of ore and coal by the implementation of good dust management practices. Allowable dust particulate limits are currently stipulated in Fremantle Ports' Environmental Licence for the site, which are currently being complied with and will continue to be complied with.

All coal and iron ore handling facilities should be completely enclosed to prevent spillage to the Sound. Best Available Technology should be used for all loading/unloading operations and transfer systems.

Fremantle Ports and HIsmelt personnel have visited facilities in Japan and Port Kembla in order to ascertain what constitutes "Best Available Technology" for coal and iron ore discharge (see discussion on investigation of world's best practice for dust suppression (response Section 4.4.1). At this stage a combination of enclosures, water sprays, well maintained equipment and good operating procedures appears to be the best practicable technology and these will be "designed" into the facility prior to the commencement of operations. Fremantle Ports' has demonstrated its ability to design and operate a best practice facility through its Kwinana Bulk Jetty operation which is used for the discharge of bulk solids. The PER (Section 7.15.7) states that this will be used as a benchmark for the HIsmelt operation.

The City of Cockburn states that there is no mention of sprinklers on the conveyors to minimise dust. This needs to be considered for those conveyors that are not covered.

Sprinklers are fitted to some of the existing conveyors at the Kwinana Bulk Berth No. 2 (KBB2). Fremantle Ports will ensure that additional sprinklers will be fitted where necessary for dust control.

How can we be sure that spillage of iron ore and coal dust into Cockburn Sound will not occur and what will be done if it does? Will the Proponent guarantee that there will be no spillage into Cockburn Sound during loading and unloading operations? It is not good enough to say that this is Fremantle Ports responsibility. Who will clean up if a spill occurs?

The management measures for the loading and unloading of ore and other materials may not be adequate to deal with the concern about the impact of dust on Cockburn Sound and their adequacy should be further demonstrated.

As mentioned above Fremantle Ports has demonstrated its capability in preventing spillages from bulk discharge operations. HIsmelt has a contractual agreement with Fremantle Ports' to undertake product handling on its behalf. The contractual agreement with Fremantle Ports includes the requirement for them provide the services in an environmentally sound manner and to minimise spillage. Should any spillage occur that presents a risk to the environment of Cockburn Sound, clean up will be undertaken by Fremantle Ports to the satisfaction of the DEWCP.

A Business Efficiency Committee has been established (as part of the HIsmelt/Fremantle Ports contractual agreement) which comprises two personnel from each of HIsmelt and Fremantle Ports. The Committee's agenda will include reviewing environmental performance and ensuring that the handling procedures and facilities are of an adequate standard. The Committee will also provide a mechanism whereby decisions on improvements can be made jointly by the parties.

The Proponent will work with Fremantle Ports, the EPA, the DEWCP, and other stakeholders to ensure that:

- there is no risk to the environment of Cockburn Sound;
- the handling of raw materials does not result in spillage or the generation of dust plumes; and
- the Dust Management Plan, to be prepared and submitted to the DEWCP, details the equipment, procedures and monitoring to be undertaken.

4.4.3 Road and Rail Transport

The Town of Kwinana stated that the Proponent should give a commitment to cover the rail wagons if dust is found to be a nuisance.

The City of Cockburn stated that the train wagons may need to be covered.

Dust from the rail wagons transporting ore is unlikely to be an issue to residents along the route. One reason for this is that the wagons will only be half filled with ore as stated in the PER (section 7.5.4). Studies and investigations undertaken by Koolyanobbing Iron Pty Ltd and the DEP on dust emanating from the rail wagons transporting ore from Koolyanobbing to Esperance (which are full with ore) found that dust is unlikely to be a problem to residents (see Section 7.5.4 of the PER).

The Proponent does not believe that it will be necessary to cover the rail wagons containing the ore as dust will not be a nuisance. In the unlikely event that dust from the ore trains is found to be a nuisance then the Proponent will request the supplier to increase the moisture content of the iron ore prior to loading of the ore onto the trains.

The City of Cockburn stated that trucks carrying lime or slag should also be required to be covered.

The lime will be delivered to the site in 40t capacity sealed tanker trucks as stated in Section 4.5.3 of the PER. The Proponent will ensure that any trucks transporting granular material to or from the site are covered and this will be included in the Dust Management Plan and the Transport of Materials Management Plan to be prepared for the Project.

The City of Cockburn request that the Dust Management Plan address the potential of dust from road and rail transport of materials.

As stated in Section 7.1.1 of the PER the EMP to be prepared for the Project will have specific Management Plans for the Transport of Materials, and Dust. As the transport of materials will be undertaken by a contracting company the management of dust will be covered in the Transport of Materials Management Plan, however, this issue will also be addressed within the Dust Management Plan. The Proponent will make the Management Plans publicly available on the HIsmelt web site and at the DEWCO and local libraries.

4.5 GREENHOUSE

Further investigations should be undertaken to ensure that the technology being proposed is producing the least greenhouse gas emissions as possible. The Proponent has not done a proper greenhouse gas assessment and has failed to demonstrate that it will take all reasonable steps to minimise greenhouse gas emissions.

As discussed in the PER the Plant will be the first commercial application of the HIsmelt Process. However, the Process has been operated at a pilot scale on the same site between 1993 and 1999. During the pilot plant test work flowsheet models were developed and validated using plant data. These flowsheet models have been scaled up to the commercial scale and used to predict the greenhouse emissions. The EPA Services Unit was provided with a Plant Flowsheet that outlines the major inputs and outputs of the Process, including greenhouse emissions. Greenhouse emissions are closely related to energy efficiency. The energy efficiency of the Plant is discussed in Section 4.1 and an energy balance was provided in the PER (Figure 4.9). The Plant and flowsheet have been designed using a conservative approach to maximise the likelihood of a successful implementation of the HIsmelt Process at a commercial scale. Process optimisation of the Plant will be aimed at minimising the quantity of energy lost through the loss streams shown in the energy balance.

The Proponent has discussed in the PER options for Process improvements that may be implemented once the technology has been proven successful. These process improvements will lead to better energy efficiency and lower greenhouse emissions. It is anticipated that these will be subject to accelerated development once the Stage 1 Plant is proven successful.

The EPA Service Unit states that while Section 7.4 of the PER provides information on CO_2 emissions from the plant in isolation, it does not provide any information on CO_2 generation from the entire project (i.e. plant site and transportation components etc). What will be the total quantity of CO_2 emitted from the entire project on an annual basis?

The calculated CO_2 emissions from the Project activities presented in the PER are those from:

- process emissions;
- natural gas combustion in the coal drying system;
- the combustion of process gas as a fuel in the Waste Heat Recovery system (for steam and power generation) and in the Hot Blast Stoves.

The PER discusses emissions from the transport of raw materials to Kwinana (Section 7.4.3.1) with a figure of 10,000t CO_2 per annum being estimated based on data calculated by Hamersley Iron/Rio Tinto Technical Services. For other components of the Project where the emissions are not well defined (e.g. truck transport of slag to customers, shipping of pig iron product) estimates have not been included. However, the magnitude of these emissions is likely to be low relative to the Process emissions. For instance Diesel usage may be around 2000L/d, which would result in CO_2 emissions of 1960 tonnes per annum, which relates to an extra 2.5 kg of CO_2 per tonne of hot metal.

Similarly no credits for the substitution of a HIsmelt by-product for a mined or manufactured product, or for the export of electricity to the grid, have been discussed in the PER.

The EPA Service Unit asks "Has the quantity of CO_2 produced per tonne of product been reduced since the HIsmelt Research and Development Facility (HRDF) commenced operations? If so, by how much? If CO_2 emissions have not been reduced, what are the reasons for this?"

The HRDF was operated on an intermittent basis only, averaging around 70 days a year at full operation. The flowsheet for the HRDF did not include energy recovery modules such as steam drives, power generation etc. Diesel generators provided emergency back-up electrical power, with one unit constantly operating during HRDF operating periods.

Consequently the HRDF did not achieve as high a level of energy efficiency as is expected in the proposed commercial scale Plants. The following values from the 1998 Greenhouse Inventory are provided in order to demonstrate this.

Metal Production	7993 t
CO_2 Emissions from Process	18732 t
CO_2 Emissions from Diesel Usage	842 t
CO_2 Emissions from Natural Gas	8545 t
Total Process CO_2 Emissions	28119 t
CO_2 Emissions from Electricity	21450 t
Total Process Emissions	3.52 t/thm
Total Emissions (inc electricity)	6.20 t/thm

However, it should be noted that natural gas usage was high as the Hot Blast Stoves were generally kept hot between HRDF campaigns. Electricity usage was also high as the pumps and other equipment were kept running during vessel heat up and cool down periods, when no production occurred In the commercial Plant the electricity will be generated by the combustion of process offgas and, hence, will be included in the process emissions.

The process emissions were also higher in the HRDF than is expected for the Commercial Plant as the area required to be water cooled was greater per volume than will be required in the Commercial Plant. This resulted in a higher energy input (coal rate) to overcome the higher energy loss to the water-cooling circuit.

The main features of the commercial scale Plant that will reduce greenhouse gas emissions include:

- a Waste Heat Recovery System which will generate sufficient electrical power and steam to eliminate the requirement to use externally generated electricity;
- lower water cooled heat loss per unit volume of the vessel reduces coal usage;
- a continuous operation which eliminates the energy wastage caused by the stop-start nature of HRDF operation; and
- the use of an Ore Preheater which will remove moisture, pre-heat and pre-reduce the ore resulting in a lower coal consumption.

The EPA Service Unit notes the various commitments made by the Proponent in relation to greenhouse gas emissions, and that Rio Tinto has commenced a three year research collaboration with Maxygen into enhanced bio-fixation of CO_2. However, the Proponent has not made a commitment to investigate other opportunities for carbon sequestration such as establishing tree farms etc in order to offset the significant quantity of greenhouse gas emissions that will be emitted from the proposed plant. Is the Proponent willing to demonstrate good corporate citizenship by making an additional commitment to investigate other opportunities for carbon sequestration such as establishing tree farms etc? If not, why not?

The Town of Kwinana supports the Proponent's commitment to employing optimum energy efficiency in Plant design and operation, and its support for research and development in new technologies and role in Greenhouse Challenge. However, "Beyond no regrets" measures should be specified.

The Town of Kwinana stated that the Proponent should be required to contribute to carbon sequestration as part of the Greenhouse Challenge Programme, particularly in the Kwinana area. Carbon trading opportunities should also be investigated to compensate for the greenhouse gas emissions.

HIsmelt is encouraged to join a programme such as the Carbon Neutral Program to offset greenhouse gases emitted during industry operations.

In response to the comment on the Proponent demonstrating good corporate citizenship on greenhouse emissions, the Proponent would like to re-emphasise the information provided in Section 7.4 of the PER on the Proponent's initiatives on Greenhouse. The Proponent has developed a Process which will significantly reduce greenhouse gas emissions per unit of production for a coal based smelting process, thereby, when the technology is implemented world wide, lowering global greenhouse gas emissions.

Rio Tinto and its businesses, including HIsmelt Operations, are currently evaluating how they can contribute to society's transition to sustainable development. For Rio Tinto, a challenge is to continue to deliver the many economic and social benefits that its products bring while also reducing greenhouse gas emissions and other environmental impacts associated with mining and mineral processing.

Rio Tinto was one of the first companies to sign on to the Australian Greenhouse Office's Greenhouse Challenge Programme, and remains committed to its goals. Rio Tinto is committed to:

- increasing efficiency and thereby reducing greenhouse gas emissions per unit of product wherever practicable throughout the life cycles of its products;
- research and development of new technologies to reduce greenhouse emissions of its processes and products;
- continuing to participate constructively in the ongoing international and national policy debate; and
- ensure that the specific actions it takes have social, environmental and economic value and withstand future scrutiny.

Rio Tinto has implemented a climate change strategy which provides a framework to reduce risks and maximise opportunities arising from local, national and international greenhouse responses.

One example of where further development of the HIsmelt Process compliments the Rio Tinto strategy on climate change is potentially its use for coal gasification and hydrogen production.

The requirement to reduce greenhouse gas emissions has resulted in accelerated research into methods for improving the efficiency of coal fired power generation. It is evident that one of the best methods of achieving this is through gasification of the coal and the use of the gas in a Combined Cycle Gas Turbine generating facility. The use of the HIsmelt Process to perform the gasification is now attracting attention from the Rio Tinto Energy Group (coal producers).

Coal gasification consists of thermal oxidation of coal with oxygen, with steam or water injection, producing a gas containing high concentrations of combustibles, predominantly hydrogen and carbon monoxide. The use of oxygen, rather than air, results in a low volume, high calorific value gas stream from which the sulphur can be economically removed prior to its use as a fuel.

The HIsmelt Process developed from a project to gasify coal by injection into a molten iron bath followed by oxidation of the carbon by gaseous oxygen to produce carbon monoxide. It was realised that the gaseous oxygen could be replaced by oxygen from iron ore to produce a direct smelting process. The transformation of the Process from smelting to coal gasification will be quite simple to engineer once the smelting technology has been proven at the commercial scale.

An extension of the gasification process that will have immense greenhouse benefits is to reform the gas with steam to produce a stream rich in hydrogen and carbon dioxide. Because the gas volume is much lower at this stage than if the gas had been combusted in a conventional gas turbine the carbon dioxide can be economically separated from the gas stream leaving a stream of pure hydrogen. The carbon dioxide can then either be utilised or sequestered using deep well injection technology. The hydrogen can then be used for the manufacture of ammonia, as a basic feed material for petrochemicals, hydrogenation of heavy oils, and the feedstock for a hydrogen economy based on fuel cells.

The Proponent will continue to investigate opportunities for offsetting the greenhouse gas emissions from the Project, including the establishment of tree plantations. These investigations will be performed either directly by the Proponent or in conjunction with other Rio Tinto Business Units that have similar offsetting requirements.

Beyond no regrets measures are discussed in Section 7.4.3.3 of the PER.

The City of Cockburn stated that further investigations should be undertaken to ensure that the technology being proposed is producing the least greenhouse gas emissions possible. The Proponent should be required to contribute to carbon sink or use carbon trading opportunities to compensate for greenhouse gas emitted.

The greenhouse gas estimates provided in the PER are based on flowsheet modelling using a computer model that has been validated against data reported from the HRDF operation. The Proponent believes that the estimates are conservative and that there is the potential for improvement.

As the proposed Plant will be the first commercial application of the HIsmelt Process there are no data currently available to support the estimates presented in the PER. However, once the Plant has been commissioned and ramped up to design production capacity, a vigorous assessment of the greenhouse emissions from the Plant will be performed. The results will be made available to DEWCP, the Australian Greenhouse Office and interested stakeholders. It should be noted that HIsmelt Corporation Pty Limited plans to market the HIsmelt Technology globally. A reduced greenhouse emission compared to currently available, conventional technology is one of the benefits being used to market the technology. As the proposed Plant will be a showpiece to aid the marketing effort it is obviously not in the Proponent's interest to have emissions that exceed the estimates listed in the PER.

It is envisaged that Asia, especially China, is an emerging market for the technology. One of the Flexibility Mechanisms available under the Kyoto Protocol, labelled Clean Development Mechanism (CDM), allows for greenhouse credits to accrue from the implementation of projects that reduce greenhouse gas emissions in developing countries. The replacement of inefficient blast furnaces in China with HIsmelt plants may be accepted as CDM projects. Through its links with one of its joint venture partners Shougang, HIsmelt is well placed to succeed in establishing plants in China.

Other greenhouse credits may accrue from the replacement of older blast furnaces in developed countries, labelled Joint Implementation Projects under the Kyoto Protocol.

The transport of coal from Queensland is unsustainable due to high transport cost and increased production of greenhouse gas.

The supply of coal from Queensland is currently the most sustainable as it results in the:

- lowest CO_2 output per tonne of pig iron produced;
- highest production output; and
- lowest operating cost. It also provides the greatest confidence for use in the commercial Plant as it was the benchmark coal trialled in the HRDF.

HIsmelt should not be allowed to burn coal.

For the HIsmelt Process coal is consumed primarily as a source of carbon that is used as a reductant to reduce the iron oxide in the ore to produce pig iron with the reaction products then being used as a fuel. From the coal consumed around 50 - 66% of the carbon is consumed as a reductant and the remainder as fuel. This represents a far more efficient, and cleaner, use of coal energy than the combustion of coal in a thermal power station.

4.6 NOISE

The DEWCP (Kwinana) requested that further noise modelling be undertaken that incorporates data estimated for the proposed HIsmelt Plant with that from the Kwinana Industries Council (KIC) cumulative noise model.

The City of Rockingham recommended that the cumulative noise impacts from the Kwinana Industrial Area including the proposed HIsmelt Plant needs to be carried out to ensure that noise exceedances of the assigned noise levels at North east Rockingham are no worse than what they are now.

The assessment undertaken for the PER (Section 7.6.4) takes into account the cumulative noise impacts, by ensuring that under light downwind conditions (worst case) to the most critical residential locations, the predicted noise levels are at least 5 dB(A) less than the assigned noise level. This is in accordance with Regulation 7(2) of the Environmental Protection (Noise) Regulations 1997. Worst case predicted noise levels for the operation of the Stage 1 and 2 Plants together are as follows:

- 7 dB(A) lower than the night time assigned noise level for Hope Valley.
- 5 dB(A) lower than the night time assigned noise level for Medina.
- 16 dB(A) lower than the night time assigned noise level for North Rockingham.
- 20 dB(A) lower than the night time assigned noise level for Wattleup.

At the time of undertaking the acoustic assessment, the KIC noise study report had not been released and hence, any comparisons could not be made. Modelling has shown that the predicted worst case noise levels are in compliance with the Regulations.

As a guide, the cumulative impact of the Project has been assessed using the worst case predicted levels from the Kwinana Industrial Area as shown in Table 4.6

Table 4.6
Assessment Of Cumulative Impact Based On KIC Report

Location	Worst Case Predicted Noise Level, dB(A)		Total Noise Level, dB(A)	Contribution from HIsmelt Plant
	Existing Kwinana Industries	HIsmelt Project Stages 1 & 2		
North Rockingham	43.6	19	43.6	0.0
Medina	48.3	30	48.4	0.1
Hope Valley	49.6	38	49.9	0.3
Wattleup	44.5	25	44.5	0.0

Hence, since the Stage 1 and 2 Plants are predicted to comply with the Regulations and show no significant increase in existing noise levels at residential areas, the Project should not cause an unacceptable impact.

The Town of Kwinana request that the Proponent provide details of the consultation with KIC relating to the regional noise levels to the Council.

The Proponent will work with and provide KIC with the estimated noise data for the Plant components for use in any future noise modelling. The results of any discussions on cumulative noise with the DEWCP and/or the KIC , or further studies undertaken will be provided to the Town of Kwinana.

The EPA Service Unit states that the PER indicates that the industry to industry noise limits will be exceeded. It goes on to discuss that this limit could possibly be the subject of a future noise regulation amendment. This information is correct, however, there is no guarantee on whether the proposed regulation amendment will come into force, or when. How will the Proponent ensure compliance with the existing limit should this regulation amendment not be enacted prior to plant operations commencing? In view of the above, is the Proponent willing to make an additional commitment to ensure that the proposed Plant will comply with the applicable regulations for industry to industry noise when the plant commences operating? If not, why not?

The Proponent has stated in the PER (Section 7.6.4) that "should the proposed change (amendment to the Noise Regulations) not be endorsed through the review, then the Proponent will review the actual noise levels and noise attenuation measures implemented at the site and will meet the criteria."

The Proponent has committed (Commitment 12.2 in Table 11.1 of the PER) to "ensure that noise levels generated by the Plant are in compliance with the Environmental Protection (Noise) Regulations, 1997."

The Town of Kwinana states that noise from the rail transport of iron ore has the potential to impact on the Homestead Ridge Special Residential Zone.

The rail route for the transport of the iron ore is shown on Figures 5.18 and 5.19 in the PER The Homestead Ridge Special Residential Zone is located more than eight kilometers from the nearest point of rail that will be used to transport the iron ore, therefore, noise from those trains will have no impact on the Homestead Ridge Zone.

The assessment undertaken on noise from the railway for the PER was a fairly generic study and can be applied to all areas adjacent the railway line such that residences will only experience noise at or below the levels nominated in the PER.

The Town of Kwinana stated that the Proponent should commit to using the quietest available rail locomotives and wagons to reduce noise impacts. Train movements through residential areas should be scheduled outside of night time periods whenever possible.

The rail freight provider is proposing to use an 82 Class Locomotive. The maximum noise levels from various types of locomotives currently used in Western Australia are presented in Table 4.7

Table 4.7
Noise Levels from Locomotive Classes Used in Western Australia

Type of Locomotive	Maximum External Noise Level at 30m
L Class	90
D Class	90
2D Class	93
P Class	85
2P Class	88
Q Class	82
2Q Class	85

Source: Herring Storer Noise Emission and Impact Assessment for the Kwinana Export Facility (Dames & Moore, 1999).

The rail freight provider has advised that at maximum power under stationary self test conditions which includes maximum throttle settings, dynamic brake at maximum and all services running an 82 Class Locomotive produces a maximum sound pressure of 87.9dB(A) at 15 m. Noise consultants Herring Storer Acoustics advised the Proponent that to extrapolate this maximum sound pressure to 30m the maximum sound would be reduced by around 5dB(A) (Herring Storer Acoustics, pers.comm., 2002.). This would result in a maximum level of 82.9 dB(A) which is similar to the levels presented for the Q Class Locomotive assuming that the maximum power conditions used for the test were the same. However , the conditions applied in the testing of the locomotives which resulted in the levels reported in Table 4.6 were not documented in the Herring Storer Noise Emission and Impact Assessment, although it is known that self test conditions for the 82 Class were for the worst case conditions resulting in maximum sound power levels.

Results from pass by noise testing conducted by the rail freight providers for similar conditions to that proposed for the transport of ore for the Project indicated that at low-power settings the 82 Class Locomotive would produce 75.2dB(A) at 20m, 67.2dB(A) at 50m and 61.2 dB(A) at 100m. It should be noted that it required two Q Class locomotives coupled together to pull the wagons required to transport the iron ore for the Kwinana Export Facility, which resulted in a maximum power level of 85dB(A) at 30m (Dames & Moore, 1999). This level is louder than the 82 Class locomotive proposed for the transport of the iron ore for the HIsmelt Project.

The preferred rail freight contractor, has provided the following information with regards to minimising noise emissions:

> "before commencing operations, [the preferred rail operator] would determine the most appropriate driver technique for noise sensitive areas so as to minimise pass by noise. This includes the most appropriate throttle settings, braking techniques and fuel saving techniques.

In addition, as part of [the preferred rail operator's] Environment, Health and Safety Management System, [the preferred rail operator] would [manage] any noise complaints and whenever possible, modify [their] operations to mitigate unnecessary noise due to operations."

It was also noted by the preferred rail operator that there are no steep gradients adjacent noise sensitive areas so low power settings can be used.

There are currently around 230 train movements per week between Forrestfield and Kwinana. The Project will result in an additional 10 movements per week for each stage of the Project. The scheduling of train movements is a complex task undertaken by Westnet who consider many factors in the scheduling. However, the rail freight provider has indicated that the trains are planned to be during daylight hours.

The Town of Kwinana requested that once the location of the slag processing facility has been determined then noise from trucks transporting the slag should be modelled. Truck movements should be kept to daylight hours.

Further studies may be required to determine the impact of noise on residents along the slag transport route once the location of the slag processing facility is known.

The average number of trucks per day carrying slag will be 24 for Stage 1 and 48 for Stages 1 and 2. This number of movements is unlikely to cause any significant increase in road traffic noise from roads already exhibiting significant traffic volumes.

If the slag is processed on site and is used for a road base or similar, the number of truck movements will be dispersed in any number of directions throughout the metropolitan area. Hence, at any one point/residence, the number of movements will be fairly low (i.e. not exposed to the total number of trucks).

Should the slag be processed at an offsite processing facility then the Proponent will ensure that an assessment of the transport of the slag is undertaken once the location of the facility has been determined. The assessment will include compliance with the draft EPA Statement EIA No. 14 on Road and Rail Transportation Noise. The DEWCP will be provided with the assessment report.

The City of Rockingham recommended that acute noise events (such as from train and ship warning horns) should be monitored to determine if they are a source of noise complaints from residents at Northeast Rockingham. A commitment should be made to continually monitor this type of noise following construction of the plant and to implement noise reduction measures where they are shown to be a problem for residents in northeast Rockingham. Nighttime loading and unloading of material should be avoided where possible.

Fremantle Ports has provided the following information. Fremantle Ports maintains a comprehensive complaints management system and database and are currently unaware of any complaints relating to train or ship warning horns in respect to the existing operations or in respect to any of Fremantle Ports' current operations. Ships do not use any warning horns except in the case of imminent danger or emergency. Noise monitoring will be undertaken and noise reduction measures will be implemented if this operation is the cause of problems for residents in northeast Rockingham.

Acute noise events from trains and ship horns are highly unlikely to be audible or intrusive at North East Rockingham (Herring Storer Acoustics, pers.comm. 2002)..

It is not considered practicable (for the optimum use of the jetty) or necessary to restrict outloading or loading to daytime only as it has been shown that noise from these activities comply with the prescribed standards of the Regulations.

4.7 RUNOFF AND WASTEWATERS

The EPA Service Unit asks "Can the Proponent clarify whether best practice control measures will be adopted to prevent groundwater contamination arising from seepage from stockpile and slag pit areas?"

The potential for groundwater contamination and the proposed management measures are presented in Section 7.12.2 of the PER. The issues and management relating to runoff and washwaters are discussed in Section 7.8 of the PER. The Proponent has committed to prepare and implement a Surface Water Management Plan, which will include the management for both clean stormwater runoff and potentially contaminated runoff and washwaters, to be submitted to the DEWCP for approval.

The Proponent has considered the following guidance statements, issued by the authorities on the management of water, in the design of the Plant:

- Management of Surface Run –off from Industrial and Commercial Sites. EPA Draft Guidance for the Assessment of Environmental Factors No.26.
- Mining and Mineral Processing . Minesite Stormwater. Water and Rivers Commission (WRC). Water Quality Protection Guidelines No.6.
- Stormwater Management at Industrial Sites. WRC Water Quality Protection Note.

These guidance statements have assisted the Proponent in applying acceptable and best management practices in Project design to minimise the potential for water contamination. Best management practice is defined by the EPA in its Draft Guidance Statement as "in general terms, the best practical method in use to achieve management objectives."

Factors considered to be best practice measures include the following:

- An impermeable clay liner will be installed in the slag pit.
- The base of the stockpile area will comprise low permeable material.
- A drainage system will be incorporated around the stockpile area to collect runoff and directed to the process water tank.
- Process wastewaters will be recycled and reused.

It should be noted that stockpiles of iron ore and coal (which were feed materials for the HRDF) have been present on the site for around ten years. The ground material under the existing stockpiles comprises sand fill. Monitoring data from the groundwater bores indicate that that there has been no contamination of the groundwater due to seepage from the stockpiles.

Potential contamination from stockpiles through leachate, runoff or dust is of concern, particularly from the sulphur in the coal which could result in acidic runoff from stockpiles.

The Proponent has stated in the PER (Section 7.8) that all potentially contaminated water will be collected and directed to the process water tank for re-use within the Plant. This includes runoff from the raw material stockpile areas. The Proponent has also stated that the stockpile area will comprise a low permeable layer to prevent groundwater contamination from leachate or runoff. In the unlikely event that sulphur does leach from the coal the leachate will be captured and directed to the process water tank.

The Cockburn Sound Management Council requested that the Proponent give a firm commitment to install a low permeability layer under the stockpiles.

The Town of Kwinana requested that the type of low permeable material to be used be specified as should its thickness and specific permeability.

The Proponent has stated in the PER (Section 7.8) that the stockpiles will be placed on a base of low permeable material, even though groundwater monitoring data have indicated that there has not been any contamination of the groundwater due to seepage from the existing stockpile area. Investigations are currently being undertaken to determine the most feasible material to be used for the large stockpile area. Various fine-grained materials will be investigated such as clay and ground slag.in terms of supply, cost, and application.

Low permeable materials are considered, in soil mechanic text books, as having a permeability of 10^{-5} to 10^{-7}m/sec. The permeability of naturals clays can be up to 10^{-9} m/sec. The thickness of the layer and the actual permeability will depend on the material selected in the final design of the Project. The selection of the material will be undertaken in liaison with the authorities. However, the Proponent expects that the material used will be compacted and have a permeability of around 10^{-7} to 10^{-9} m/sec and may be laid at a thickness of up to 250mm (depending upon the selected material), which will be covered with a protective soil layer.

The Cockburn Sound Management Council stated that the Proponent should commit to an outcome rather than commenting on the method it chooses to achieve control of runoff and leaching.

The Proponent should commit to and technically specify how it intends to meet a zero groundwater pollutants discharge target.

The Proponent will comply with the environmental objective of maintaining the quality of surface water and groundwater so that existing potential uses, including ecosystem maintenance, are protected by implementing the management measures discussed in the PER and in the above responses.

The Proponent will continue and expand its groundwater monitoring programme to ensure that groundwater is not being adversely affected by the Project.

HIsmelt should establish themselves as world leaders in environmentally sustainable initiatives by recycling and reusing wastewater. Seepage water and leachates should be recovered from the site and sprayed back over the stockpiles to prevent wind drift.

Water in the Process will be recycled as shown on the water balance (Figure 4.10 in the PER). The main wastewater from the Plant will be blowdown from the scrubber and the clarifier circuit that must be removed once the concentration of total dissolved solids (TDS) reach a level that can be detrimental to Plant operations. The wastewater will be reused for the cooling of pig iron and slag.

The measures implemented for the management of water on the site will ensure that there is no seepage or leachate from potentially contaminated areas. Runoff from around these areas will be collected and directed to the process water tank from where it will be used on the stockpiles for dust suppression.

The EPA Service Unit states that the disposal of process wastewaters via a soakaway to groundwater and Cockburn Sound is a priori considered to be unacceptable, unless it could be demonstrated that it would not compromise any of the environmental quality objectives of the Sound. This has not been adequately demonstrated in the PER document. The Proponent needs to provide additional information in order to address this concern.

There will be no disposal of process wastewaters via soakaways to groundwater. The management of process wastewaters is addressed in detail in Section 7.11.2 the PER. The only water discharged to soakaways will be clean runoff.

The Water Corporation recommends that additional water storage be constructed to cater for the influx of heavy rainfall during very wet winter months. An option should be considered to cover the storage tanks to prevent rainfall incursion, which would circumvent the need for either additional storage or ocean disposal.

The Proponent plans to construct additional water storage capacity on site for the collection of rainfall runoff as this water can then be used for the Plant operations. The collection of rainfall directly into the storage tanks will be a minor issue when compared to the quantity of stormwater runoff collected from the stockpile area which will be directed to the process water tank. Therefore the covering of the storage tank will be inconsequential in terms of reducing the volume of rainfall collected

Contaminated water must not be discharged into Cockburn Sound or via Cape Peron, it should be evaporated on site and the solids taken to a Class 4 landfill.

The Proponent has, both in the PER and at community briefings, stated that there will be no discharge of effluent to Cockburn Sound. As outlined in the PER potentially contaminated run off water will be collected and delivered to the process water tank where it will be mixed with blowdown from scrubber circuits, treated with lime to raise the pH and then re-used in cooling applications. Heavy metals in solution will be precipitated due to the pH change and settle out with other suspended solids.

The major contaminant load of the waste water is likely to be due to suspended solids collected from the stockpile area. The contaminants in the waste water are expected to settle as solids deposit in the cone section of the process water tank, which was originally the clarifier pond for the HRDF. The solids may be pumped out via the existing underflow pumps to a batch filter and will be dewatered. The solid material will then be tested and if not suitable for recycling to the process they will be sent to an approved landfill.

The water balance for the site, presented in the PER, indicates that the demand for water from the waste water tank for cooling of the slag and pig iron, and dust control on the stockpiles will be higher than the expected input from the Process blowdown streams. Therefore storm water run off from the stockpiles will be collected and also used for cooling purposes and dust control.

Only in extreme rainfall events, when on-site storage capacity and process demand is exceeded, will there be any requirement to discharge water off site. If such disposal is necessary the water will be treated to meet the requirements for input into the Water Corporation's Cape Peron Outfall such that the discharge complies with the Water Corporation's Licence to Discharge. The EPS Water Corporation advised during a presentation in July 2002 to the industries participating in the KWRP that an environmental impact assessment document is being prepared for the KWRP to seek environmental approval. The document will include a description of the 'KWRP Governance Model for Control of Industrial Discharges to the Cape Peron Outlet Pipe (CPOP)'.

If Environmental approval for the KWRP and the associated industrial effluent discharge through the Cape Peron Outlet Pipe is forthcoming then that Governance Model will set the parameters for acceptance of industrial effluent, with early indications that these parameters will be based on ANZECC Guidelines or the DEP Licence Limit (for existing industries), whichever is the lower. The Model also includes control measures for ensuring that composition standards are met in each individual industry participant's outlet pipe prior to it entering the CPOP.

The Cockburn Sound Management Council stated that it supported the fact that contaminated wastewater should be separated from other sources, treated and discharged into the Point Peron wastewater pipeline.

This is the Proponent's proposed management plan for contaminated wastewater. However re-use on site is the favoured disposal option with discharge to the Cape Peron line only required in instances of extreme rainfall events when on site storage and demand is exceeded.

The Cockburn Sound Management Council stated that in the event that the wastewater does not meet the criteria for discharge then it may need to be pre treated or evaporated on site.

Should the Water Corporation agree to accept waste water from the Plant it will specify the quality that is acceptable. The Proponent will ensure that any waste water that is to be disposed via the Cape Peron line s treated to meet the Water Corporation's specifications. The Water Corporation, in granting access to the CPOP, will require on-line monitoring instrumentation to be installed on the outlet from the Plant to ensure that specifications are met at all times and any exceedances are identified immediately.

Information is required on the wastewater to be disposed of through the Cape Peron outfall, a list of the contaminants and levels of those contaminants and the predicted flows of wastewater.

The PER (section 7.11.2) discusses scenarios where effluent disposal might become necessary in Section 7.11.2. Estimates of flow rate and effluent composition have been tabulated for each scenario. The Proponent is investigating options for retaining storm water on site for re-use at a later stage in order to limit the requirement for off site disposal.

The Water Corporation states "No waste water quality data are provided in the PER, making approval of the option of disposing of wastewater through the Water Corporation Cape Peron Outlet line risky for both the EPA and Water Corporation."

The PER (Section 7.11.2) discusses scenarios where effluent disposal might become necessary in Section 7.11.2. Estimates of flow rate and effluent composition have been tabulated for each scenario. This information was also provided to the Water Corporation in March 2002 for use in the EIA for the KWRP project. The Proponent stated in the PER that the water will meet the ANZECC criteria relevant at the outfall (Protection of 90% of species).

The City of Rockingham states that given the uncertainty as to what substances will be in the waste water, approval to dispose of waste water through the Water Corporation's Cape Peron Outlet pipeline should be opposed.

The Proponent has committed to the sampling and analysis of the water in the process water tank on a regular basis in order to ascertain its composition. The purpose of this commitment is to ensure that the water quality will meet the Water Corporation's specification should disposal through the Cape Peron line be required. The results of such monitoring will be provided to the Water Corporation. As discussed in an earlier response the Water Corporation is seeking environmental approval for the KWRP and is also developing a Governance Model for Control of Industrial Discharges to the Cape Peron Outlet Pipe, which will set the parameters for acceptance of industrial effluent.

The EPA Service Unit states that from the information provided in Section 3.5.1.2 of the PER, it appears that the effluent is likely to contain a suite of heavy metals, including Al, As, Cd, Cu, Cr, Pb, Zn, Mn and possibly others. An upper estimate of the annual loads of these contaminants discharged to the Cape Peron line [or a soakaway (soak pit)] needs to be provided by the Proponent.

The Proponent has no intention of discharging process waste water to soak pits. Only clean run off will be directed to such infiltration basins (see Section 7.8 of the PER). The Section 3.5.1.2 of the PER is a discussion of the disposal options for potentially contaminated water. The option for disposal to soak pits was dismissed due to the potential for groundwater contamination.

The PER discusses the environmental management measures to be implemented to ensure that the concentrations of any of the metal species referred to in the submission are below the ANZECC criteria for discharge to marine waters. If disposal is necessary the water will be treated to meet the requirements for input into the Water Corporation's Cape Peron Outfall such that the discharge complies with the Water Corporation's Licence to Discharge. As discussed in an earlier response the Water Corporation is seeking environmental approval for the KWRP and is also developing a Governance Model for Control of Industrial Discharges to the Cape Peron Outlet Pipe, which will set the parameters for acceptance of industrial effluent.

The EPA Service Unit asks "What would the contaminant loads in the process wastewater overflow be during storm events etc, and what effect would this have on the total contaminant loads through the Cape Peron pipeline? Although the PER does include some discussion of non-normal operations modes, the proponent needs to indicate whether these modes would result in any effluent discharge."

Table 7.22 in the PER presents an estimate of the composition of the wastewater at the intake of the process water tank and what any overflow caused by excessive rainfall may contain for scenarios where the tank is 25%, 50% and 75% full prior to the rainfall period. These data were provided to the Water Corporation for use in the preparation of their environmental impact assessment of the KWRP. The treatment proposed for the water in the process water tank will reduce the levels of contaminants to below the relevant ANZECC criteria as discussed in Section 7.11.2.

If disposal is necessary the water will be treated to meet the requirements for input into the Water Corporation's Cape Peron Outfall such that the discharge complies with the Water Corporation's Licence to Discharge. As discussed in an earlier response the Water Corporation is seeking environmental approval for the KWRP and is also developing a Governance Model for Control of Industrial Discharges to the Cape Peron Outlet Pipe, which will set the parameters for acceptance of industrial effluent.

The EPA Service Unit states that the estimated process wastewater overflow during storm events etc is of order $0.1 m^3/s$*, which is about 5-10% of the capacity of the Cape Peron Outfall (CPO). However, under these conditions, the flows from all streams to the CPO would be peaking. Is the proponent sure that the capacity of the CPO pipeline would not be exceeded under these conditions? This needs to be clarified.*

The EPA Service Unit states that additional detailed information needs to be provided by the Proponent in relation to the risk of the Cape Peron pipeline becoming unavailable for varying lengths of time, and the resulting implications for the volumes and characteristics of the effluent from the Plant.

Advice from the Water Corporation (Jeff Ibbott, Industrial Operations Coordinator – Bulk water and Wastewater Division, June 2002) is that the Cape Peron outfall line has been unavailable for use on two occasions in the 20 years since its construction. One of those occasions was early in 2002 for the installation of nozzles to allow the line to feed the KWRP and also the industrial effluent line to be connected at a later date.

It is unlikely that the line would be unavailable for any significant period. As stated in the PER the Proponent plans that, under all but extreme rainfall events, there will be no discharge of effluent off site. The probability of the two events coinciding is very low. However, as other industrial sites will also be dependent on the Cape Peron pipeline the Water Corporation has advised that it is considering the construction of an intermediate storage tank to provide capacity for such events and also provide a buffer between industry and the outfall to allow Water Corporation to manage the flows.

The current flow through the Cape Peron pipeline is 100 – 110 ML/d. This will be reduced by approximately 20ML/d when the KWRP is in operation. The rated capacity of the outfall is 240ML/d, therefore, there is ample capacity in the Cape Peron line to cater for additional flow following periods of heavy rainfall.

The EPA Service Unit states that the paragraph under Table 7.22 on page 7-66 of the PER states that "It should be noted that where the < sign is presented in Table 7.22 this implies it will be less than the ANZECC criteria for discharge to the marine environment, the relevant criteria being that applicable for the Sepia Depression where the outfall is located." The proponent needs to clearly indicate what the applicable ANZECC criteria is for discharge from the Cape Peron Outfall into the Sepia Depression in terms of ecosystem protection [i.e. species protection levels (e.g. 90%, 95% and 99% etc) and water quality].

As stated in the PER Section 7.11.2 "Advice from the environmental section of the Water Corporation is that the mixing zone of the outfall is a highly disturbed zone according to the ANZECC criteria but outside the mixing zone the applicable criteria is for a slightly-moderately disturbed system.

The ANZECC criteria referred to is the National Water Quality Management Strategy Australian and New Zealand Guidelines for Fresh and Marine Water Quality prepared under the auspices of the Australian and New Zealand Environment and Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

The Guidelines state that the a 95% protection level trigger values should be applied to ecosystems that are classified as *slightly-moderately disturbed,* although for a few chemicals higher levels of protection are recommended. Table 3.4.1 in the ANZECC guidelines present the trigger values that apply to *slightly-moderately disturbed ecosystem.*

For ecosystems that are classified as *highly disturbed,* the 95% protection trigger value can also apply. However, protection levels of 90% or perhaps 80% may also be appropriate.

The EPA Service Unit asks "What will be the environmental fate of the flocculant and wetting agent referred to on page 4-37 of the PER? Is there any chance that they will enter the marine environment? Can the Proponent provide information in relation to their environmental performance?"

The actual flocculant to be used in the Process will be selected during the commissioning of the Plant, as each type of flocculant is material specific. The Proponent has stated in the PER (Section 4.5.4.3) that they "will ensure that the potential environmental impacts of the chemicals (used in the Process) are considered during the vendor selection process. The Proponent will consult with DEWCP to ensure that the chemicals proposed for use by the water treatment contractor are considered environmentally acceptable".

In addition, the Proponent is designing the Plant to have zero wastewater discharged offsite with the exception of runoff collected from periods of extended extreme rainfall events.

The Town of Kwinana stated that wash down areas should be fitted with a vertical gravity separator or equivalent hydrocarbon arrester.

There will be minimal use of hydrocarbons on site. Diesel will be used as a fuel in mobile equipment and in emergency back up pumps. The storage of diesel will be in appropriately designed above ground tanks within concrete bunds. No wash down area with the potential for hydrocarbon contamination of the wash water has been identified on the proposed Plant layout. Should such a wash down area be incorporated during the detailed design phase then it will incorporate the necessary vertical gravity separator for the control of hydrocarbons.

The Town of Kwinana stated that the potential for contamination from pipeline leaks should be addressed.

The only pipelines within the Plant will either contain water or gas. Cooling water circuits are critical to the safe operation of the Plant and hence will have instrumentation that monitors flow rates and other parameters that rapidly inform operators if a leak has developed. The closed circuit cooling systems, which have the highest concentration of chemical additives, will all be contained within the confines of the building housing the Smelt Reduction Vessel, an area where any spillage will be drained to a sump and then directed to the process water tank.

The Town of Kwinana stated that the Surface Water Management Plan should be available for public assessment.

The City of Cockburn stated that a Drainage and Wastewater Management Plan should be developed which addresses the prevention of contaminated groundwater and surface water entering Cockburn Sound.

A Surface Water Management Plan will be prepared, as discussed in Section 7.8 of the PER, and will include the management of both clean and potentially contaminated runoff and wastewaters on the site. The Surface Water Management Plan will be made publicly available on the HIsmelt web site and at the DEWCP and local libraries.

The EPA Service Unit states that the Proponent needs to demonstrate that its groundwater monitoring programme will be designed to enable early detection of contaminant seepage should it occur.

The EPA Service Unit states that the Proponent needs to state the criteria (i.e. the triggers) for implementing management measures to stop any emerging seepage/groundwater contamination problem.

A groundwater monitoring programme has been undertaken at the site since 1990. Monitoring is conducted on a quarterly basis and the parameters analysed are in accordance with the DEP licence for HIsmelt operations. Additional groundwater monitoring bores will be installed within the extended HIsmelt lease area as shown on Figure 5.15 of the PER. The Proponent, in liaison with the DEWCP, will reassess the parameters to be monitored.

The historical groundwater data are presented in Appendix D of the PER together with the relevant guidelines. Section 5.7.4 of the PER discusses the derivation of the guideline (criteria) values that have been applied.

The Town of Kwinana stated that groundwater monitoring bores should be located downstream of all feedstock and storage stockpiles to ensure early detection of pollution. Results from these monitoring bores should be reported to the Town of Kwinana and DEWCP on a six monthly basis.

The PER (Section 5.7.2) discusses the network of groundwater monitoring bores located on the site and the fact that they are located with a view to detection of contamination from areas such as the raw material stockpiles, slag storage area, stormwater infiltration basins etc. Appendix D of the PER contains the complete data set for historical quarterly sampling and analysis of the groundwater in those bores. The location of the existing and the new proposed bores are shown in Figure 5.15 of the PER. The locations of the new bores have been selected to monitor the proposed new slag pits and new infiltration basins. The Proponent has made a commitment to continue the quarterly groundwater-monitoring programme.

Reporting of the results on an annual basis allows for a review of the seasonal variations in groundwater quality. However, the Proponent will report the results on a six monthly basis if it is considered necessary.

The City of Rockingham supports the commitment to extensively monitor the groundwater. However, the commitment to report groundwater monitoring results on an annual basis is inadequate. The Proponent should report to DEWCP immediately evidence of contamination and causes of that contamination.

Historically the groundwater data have been provided to the DEWCP on an annual basis, as required by the site's licence, which presents the trends of the years monitoring. The Proponent will immediately notify the DEWCP of any exceedances of the relevant guideline values. The Proponent would also investigate the cause of the exceedance.

4.8 SOLID WASTE

The Town of Kwinana, stated that construction waste should be analysed and confirmed to be free from contamination prior to being released for processing at a materials recycling facility.

The recycling and reuse of wastes will be maximised where practicable. If the waste is not suitable for direct recycling or reuse, or processing for reuse then it will be directed to an appropriate and approved landfill according to the DEP's Guidelines for Acceptance of Solid Waste to Landfill.

The Town of Kwinana stated that the stockpiling of waste on the site should be kept to a minimum and for only short lengths of time.

The Waste Management Plan prepared will be based on the principles of Reduce, Recycle and Reuse and it will define the waste disposal practices for the site. The Plan will ensure that wastes are minimised and are disposed of in an environmentally acceptable manner.

4.9 SLAG

There is no mention of the disposal of slag. The production of 800,000 tonnes of pig iron will produce 500,000 tonnes of slag. What are the disposal methods for dealing with the expanding slag dumps? People should be given a detailed explanation as to how the slag waste disposal problem is to be dealt with.

Slag as a by-product is discussed in detail in Section 4.12.2 of the PER, and the issues and management relating to slag are discussed in Section 7.9 of the PER.

The quantities of slag produced as documented in the PER are 225,000 tonnes per annum (tpa) for Stage 1 (producing 820,000 tpa of pig iron) and 450,000 tpa for Stage 2 (producing 1.6Mtpa).

The recycling and reuse of slag should be given high priority.

The Town of Kwinana has stated that the management of slag should be addressed in the Waste Management Plan and a commitment should be made not to landfill the slag or a Memorandum of Understanding should be undertaken with a suitable user.

The Proponent believes that the slag generated by the Process is a valuable by-product and should not be considered a waste. The Proponent is in discussions with potential customers and has committed to continue to investigate the value added options for its use. It is envisaged that the slag will be sold as a by-product to the construction industry for use as aggregate (replacing product from hard rock quarries), as a road base, as a constituent of asphalt and also as a raw material for cement production. A study has been commissioned by the Proponent to investigate the use of slag as a road base material, which would be beneficial as it would reduce the quantity of quarried material which is currently used in this application. The Proponent is also commissioning a study into the suitability of the slag for use in agricultural applications.

It is the Proponent's intention that the slag will be recycled or reused rather than be directed to a landfill. The management of slag will be included in the site's Environmental Management Plan.

The Town of Kwinana requested that a groundwater monitoring bore be located downstream of the slag stockpile to ensure detection of any pollution. Results of annual monitoring should be provided to DEWCP. A response plan detailing actions if any contamination is detected should be specified.

Groundwater monitoring bores already exist down gradient of the HRDF slag pit areas (Bore BH9) and of the proposed slag processing area (Bore BH5) as shown on Figure 5.15 in the PER, and an additional bore will be installed down gradient of the proposed slag pits (see Figure 5.15 of the PER). Monitoring results from the bore (Bores BH 5) located down gradient of the existing slag stockpile have shown that there has been no increase in leachable species in the groundwater (see Appendix D in the PER).

The Proponent should make a commitment to not dump the 450tpa of waste slag generated around the site or in landfills. The slag processing facility should have been included in the PER. Once the location of the slag processing facility has been determined , an assessment of the potential impacts may be required which includes community consultation.

The slag will be a by-product stream from the Plant and not a waste. Throughout the world similar slag is totally utilised as aggregate, road base, in cement production and for asphalt production. The Proponent believes that this will also be the case for the slag generated at the Plant. To confirm this the Proponent has commissioned a study by Sinclair Knight Mertz to investigate potential uses, and is also undertaking investigations for its use for agricultural applications.

It is anticipated that the slag processing facility will comprise a simple crushing and screening operation to produce aggregate to customers' specifications. If located on site the facility will be subject to the Management Plans prepared for the site. Any offsite slag processing facility will be subject to approval, if not already approved, and an Operating Licence from DEWCP.

The City of Cockburn stated that further studies may be required to determine the impact to residences from the transport of slag, once the location of the facility is known.

The Town of Kwinana requested that once the location of the slag processing facility has been determined then an assessment should be undertaken by DEWCP to ensure that offsite impacts are acceptable. The Council requested to be consulted through the assessment process.

At the time of preparation of the PER it had not been determined if the slag processing would be conducted either on site or offsite as the Proponent is continuing to investigate the best option. While a decision has not been finalised it is currently considered likely that the slag processing facility will be located at the HIsmelt site in the area marked on Figure 4.2 of the PER as "Slag Processing Area".

The slag processing will include crushing, screening, sorting and the recovery of metallic material from the slag, which will be returned to the Process. The slag will then be sold for use in the construction industry as discussed above. As the end users of the slag are not known at this stage the transport routes are also unknown. However, it is expected that the roads used will already be subject to heavy truck traffic and that the slag transport will represent only a minor increase.

4.10 SITE CONTAMINATION

The Town of Kwinana has stated that any contaminated areas with the potential to be disturbed during construction or that require remediation should be addressed through a remediation plan. The possible impacts and design issues relating to site contamination should be specified.

The Cockburn Sound Management Council stated that the Proponent needs to strengthen its commitment to ensure that any potential contamination associated with construction is remediated so there are no significant offsite impacts.

More information and an additional commitment on groundwater and site remediation is required.

Since the preparation of the PER the Proponent has undertaken a Stage II assessment of the on site contamination to determine the extent of known contamination and to identify other areas of contamination that may be disturbed by Project activities. Preliminary results indicate that no additional areas of contamination were identified.

A Remediation Plan will be prepared and implemented by Landcorp for any contaminated areas on the site that have the potential to be disturbed by construction, and require remediation. The Remediation Plan will identify areas that require remediation and the proposed remediation management measures. All remediation work will be undertaken in an environmentally acceptable manner consistent with the DEP's Guidelines for Contaminated Sites. Any areas identified as being contaminated and that have the potential to be disturbed by the Project will be remediated and therefore will not cause offsite impacts.

It is believed that the site contains high contamination levels of heavy metals such as mercury, which has not been addressed in the PER. More details are required on site contamination and groundwater contamination levels.

Landcorp provided data to the Proponent on levels of groundwater and soil contamination at the site, which is presented in Section 5.8 of the PER. Table 5.4 of the PER lists the typical concentration levels for metals in material on the site. Mercury levels in all of these materials were found to be below the detection limit of 0.1 mg/kg. The ecological investigation level for mercury is 1mg/kg.

In addition to the Landcorp data, the results of groundwater monitoring undertaken by HIsmelt since 1990 are summarised in Appendix D of the PER.

A Stage II site investigation has been undertaken on the site. The report from the investigation has been provided by the owners of the site, Landcorp, to the DEWCP.

4.11 ROAD TRANSPORT ROUTES

The Town of Kwinana states that the proposed extension of Anketell Road as shown in the FRIARS report is the preferred option for the eastern connection to the industrial area. The proposal needs to take into account the extension of Leath Road and Mason Road for north/south industrial traffic movements.

The Office of Major Projects (OMP) in the Department of Mineral and Petroleum Resources (DMPR) advised the Proponent that OMP has recently instigated a study to revise the Kwinana Central Core Structure Plan, which will aim at showing the optimal configuration for land use, transport and services. The scope of the study includes a requirement to:

- review the broad travel and transport demand and assess transport access options;
- focus on the need for revised landuse and infrastructure planning in Kwinana's central core brought about by the HIsmelt lease area and other landuse scenarios, resulting from the recent acquisition of the Kwinana BHP site by LandCorp/Fremantle Port Authority;
- ensure effective east-west regional road access to proposed port areas and supporting north-south internal road access linkages;
- include land reservation plans and supporting information suitable for inclusion in a future Metropolitan Region Scheme amendment for these strategic transport links; and
- recommend ways to ensure that the central core area is effectively and efficiently connected with regional, State and inter-state infrastructure (eg road, rail and services).

The study will also address:

- the proposed Fremantle-Rockingham controlled access highway and access to the proposed port area, such as the possible extension of Anketell Road (but not on the alignment that passes through the HIsmelt lease area);
- the internal road structure and the capability to deal with emergency response; and
- road access for high and wide loads and connections to State high and wide load system.

The working group for this study will report to the Kwinana Industries Coordinating Committee.

The Town of Kwinana states that traffic volumes created by to the Project are expected to exceed the capacity of the local road networks. An upgrade of Leath Road and Beard Street will be required to allow for the project traffic. Increased traffic volumes are also expected to exceed the capacity of the Beard Road and Rockingham Road intersection and further upgrading of the intersection will be required.

Advice sought by the Proponent from the Government authorities during the preparation of the PER indicated that the roads servicing the site have the capacity to allow for the estimated Project traffic. Beard Street and Leath Road currently service the industries along these roads, which results in many existing heavy vehicle movements. BHP had advised that there are currently around 70 truck movements per day to the BHP Transport Logistics business located at the end of Leath Road. These truck movements will cease at the end of 2003 when BHP's business is relocated. There will be up to 73 truck movements per day associated with the Stage 1 Plant, as listed in Table 7.23 of the PER, therefore the actual increase of heavy traffic along Beard Street and Leath Road associated with the Stage 1 Plant will be insignificant. There will be an additional 73 truck movements for the two Stage Plants.

Main Roads WA advised the Proponent that the additional truck movements due to the Project will not have a significant impact on the operation of the Rockingham Road/ Beard Street intersection.

The Proponent will continue to investigate these matters with the local Council and Government authorities.

The increase in traffic movements for the Project accounts for one truck every ten minutes which is a large increase and constitutes a threat to safety.

There will be 73 truck movements per day for Stage 1 and 146 truck movements for Stages 1 and 2 operating. The increase in heavy vehicles on the roads servicing the site was estimated in the PER based on the available data. The estimated increase of heavy vehicles for both Stages of the Project will be 35.2% on Leath Road (based on 1995 data), 26% on Beard Street (based on 2000 data), and 3.2% on Rockingham Road (based on 2001 data).

It is understood that this proposed increase in heavy vehicles can be accommodated on the roads and particularly the Beard Street/ Rockingham Road intersection as the risk of accidents at intersections tends to be greater. The Proponent acknowledges that there will be some increase in the potential risk for accidents due to the Project traffic.

The City of Cockburn states that further information needs to be provided on the routes to be taken by trucks transporting material to and from the site and the impacts should be further investigated.

The Town of Kwinana does not support the transport of raw materials via Thomas Road due to amenity risk issues Trucks should be encouraged to use Anketell Road rather than Thomas Road.

The major local service roads for the site are Rockingham Road, Leath Road and Beard Street. The impacts of the increase in traffic and noise along these roads are discussed in the PER. Trucks transporting materials to and from the site will use the broader road infrastructure with the route depending on its start point or destination. The transport routes for the area are subject to a study being commissioned by OMP as discussed previously.

Depending on the start point of the truck movements, Anketell Road is likely to be preferable for trucks traveling to or from the east as it is closer to the HIsmelt site than Thomas Road.

4.12 MARINE ENVIRONMENT

4.12.1 General

The Department of Planning and Infrastructure stated that it would like to acknowledge the Proponent's intention to ensure that ships chartered meet the requirements of the Right Ship System. Thus ensuring that only well maintained vessels operated by companies with good management principles (including operating procedures and manning requirements) will be chartered.

The Cockburn Sound Management Council expressed concern that the approach to stating that Fremantle Ports is tasked with having responsibility for certain key environmental outcomes is unsatisfactory as key environmental impacts are not covered in the PER. It is not clear as to the level of responsibility and commitment by the Proponent to achieving acceptable outcomes.

The Proponent will work with Fremantle Ports in order to ensure that key environmental outcomes over which Fremantle Ports has control will be achieved. (see Response 4.4.2). A Business Efficiency Committee has been established which comprises personnel from HIsmelt and Fremantle Ports. The Committee's agenda will include reviewing environmental performance and ensuring that the handling procedures and facilities are of an adequate standard. The committee will also provide a mechanism whereby decisions on improvements can be made jointly between the parties.

There should be " no net loss of ecological or social function" for Cockburn Sound.

The Proponent and Fremantle Ports agree that there should be no net loss of ecological or social function of Cockburn Sound and will implement that management measures documented in the PER.

The Proponent has said that initially the lime would be sourced from Cockburn Cement. This is unacceptable due to the degradation caused to the environment of the Sound by Cockburn Cement's operations.

The Proponent has investigated sources of suitable lime to be used in the Process. Cockburn Cement, which produces lime on a commercial basis, was identified as a potential supplier. Cockburn Cement operations have been approved by the EPA and are licensed by the DEWCP. The major benefits of sourcing lime from Cockburn Cement include it being in close proximity to the HIsmelt Plant, which will minimise transport distance, and the fact that it is generating business for local industry.

It should also be noted that slag produced as a by-product of the Process may, if properly treated, be used in cement production which could replace some of the dredged material currently used in the manufacturing of cement. The Proponent is evaluating this option as discussed in Section 4.12.2.1 of the PER.

4.12.2 Spillage

The Cockburn Sound Management Council requested that Hismelt need to make a firm commitment to ensure that Fremantle Ports employ practices to minimise dust and spillage.

A zero spillage target and a fully specified management plan should be produced prior to approval.

As indicated above, the Proponent commits to working with Fremantle Ports to ensure that practices are employed to achieve a target of zero dust and spillage. Fremantle Ports has advised that they will produce a fully specified Management Plan which includes a zero spillage target prior to commencement of operations.

4.12.3 Marine Pests/Pollution/ Contamination

The Cockburn Sound Management Council stated that baseline information on marine pests and TBT levels in the vicinity of the HIsmelt proposal should be included in the PER.

Heavy metal contamination such as mercury exists around the old BHP jetties and this should have been covered in the PER. More information is required on the sediment contamination.

Baseline information on marine pests and sediment contamination in Cockburn Sound is provided in Sections 5.12.6 and 5.12.4 of the PER, respectively.

Fremantle Ports has provided the following additional information. A study was undertaken by D.A. Lord and Associates for the Kwinana Industries Council in 2000 and reported in the "Characteristics of Sediment in Perth's Nearshore Coastal Waters". Sampling for the study was undertaken in the vicinity of James Point with the results indicating that the all metals and TBT are below the ISQG- low criteria.

Sediment analysis was conducted by Sinclair Knight Merz in 2001 on behalf of Fremantle Ports. The results were provided to the DEP in support of approval for maintenance dredging that was conducted around the jetties. The results of the analysis have been provided by Fremantle Ports and are presented in Table 4.8.

Table 4.8
Analysis of Sediments

Parameter	Unit	BHP North	BHP West	EIL	ANZECC ISQG-low	ANXECC ISQG- high
Aluminium	mg/kg					
Arsenic	mg/kg	4.8	4.9	20	20	70
Cadmium	mg/kg	<0.5	<0.5	3	1.5	10
Chromium	mg/kg	33	29	50	80	370
Copper	mg/kg	37	14	60	65	270
Mercury	mg/kg	0.16	0.11	1	0.15	1
Lead	mg/kg	12	10	300	50	220
Nickel	mg/kg	7	8	60	21	52
Zinc	mg/kg	59	41	200	200	410
Total Organic Carbon	%w/w	1.43	1.12			
Monobutylin	ng/g	8	5			
Dibutyltin	ng/g	10	5			
Tributylin	ng/g	9	3	50000	5	70

Source: Fremantle Ports
EIL – Ecological Investigation Level

The data in Table 4.7 indicate that the low levels of heavy metal contamination were not significant.

TBT levels in the vicinity of the jetties were also investigated as part of the Sinclair Knight Merz study. The TBT levels in the area were found to be below and slightly in excess of "Interim Sediment Quality Guidelines - low" levels as documented in the ANZECC and ARMANCZ National Water Quality Management Strategy Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

The Baseline Survey for Marine Pests conducted by the CSIRO in 1999/2000 identified the presence of the European Fan Worm (*Sabella spallanzanii)* at a number of sites throughout Cockburn Sound including the vicinity of these jetties.

The Cockburn Sound Management Council questioned whether the Mandatory Ballast Water Requirements adequately cover the movement of shipping ballast water between Australian ports?

There appears to be no requirement for the management of ballast water into Cockburn sound from shipping.

Ballast water management in Cockburn Sound is under the control of the Australian Quarantine and Inspection Service (AQIS) as described in Section 7.15.5 of the PER and in Fremantle Ports' Environmental Fact Sheet No.2 in Appendix I in the PER. Ballast water is not permitted to be discharged unless authorised in writing by a Quarantine Inspector. Arrangements at a national level are still to be made to incorporate equivalent controls for ships moving ballast water between Australian ports. However, ships calling at the facility from other Australian ports will be loaded with raw materials and backloaded with product for exppրt which means they will not be discharging ballast water. Any ships arriving to load product for export will arrive from overseas and will be subject to the AQIS controls.

The Proponent should undertake some baseline research in order to determine any impacts of the development of TBT and changes in future ecology of marine organisms at the site.

Fremantle Ports advised that it is not appropriate for the Proponent to undertake this type of research as it relates to the marine component of the Project which is under the control of Fremantle Ports. Fremantle Ports has been involved in supporting many areas of research and investigation in port waters and will continue to provide support to projects as they arise.

The Cockburn Sound Management Council stated that the PER mentions that the iron ore has a high phosphorus content. The fate of the phosphate should be clarified.

What happens to the phosphorus? Where does it end up after processing? The proponent should address the potential of phosphates enriching groundwater and Cockburn Sound. $P_2 0_5$ *emissions could also be a problem.*

The iron ore fines proposed for use in the HIsmelt Plant(s) will have a phosphorus content considered high for iron making standards. However, the phosphorus content is expected to be <0.2%, which can be compared to 0.08% in the typical feed for blast furnace and HBI processes.

The HIsmelt Process has demonstrated that such 'high phosphorus' ores can be used as feed because the phosphorus preferentially reports to the slag phase rather than to the metal (see Section 4.8.1 of the PER). The phosphorus will be contained in the slag, once it has been tapped from the furnace and cooled, as calcium phosphate within a calcium aluminosilicate lattice.

The cooled slag will be a very stable material. This has been demonstrated as the slag that remained from the HRDF (a small stockpile remained for test work purposes) showed no evidence of weathering. In addition, groundwater monitored in a bore down gradient from the slag stockpile area has shown no evidence of species leaching from the slag. The management of slag is discussed in Section 4.9 of this report.

It is not envisaged that any gaseous phosphorus species will be produced in the Smelt Reduction Vessel or emitted from the Plant. Phosphorus in the ore or slag is not leachable, therefore, it will not contribute to phosphorus inputs to Cockburn Sound.

The Town of Kwinana states that the PER should address concerns about nutrients such as phosphates from coals and nitrates from scrubbers. The Proponent's commitment to replace existing septic systems with nutrient retentive sewerage systems is supported by Council.

The Proponent has stated in the PER (Section 7.8) that all potentially contaminated water will be collected and directed to the process water tank for re-use within the Plant. This includes runoff from the raw material stockpile areas. The Proponent has stated that the base of the stockpile area will comprise a layer of low permeable material to prevent groundwater contamination from leachate or runoff. In the unlikely event that phosphates do leach from the coal or iron ore (in fact the iron ore has a higher phosphorus content than the coal) the leachate will be captured and directed to the process water tank.

The levels of nitrate in the scrubber circuit water is expected to be low as the process does not produce nitrates, the offgas that contacts the water in the wet scrubber will not contain NO_x. The FGD blowdown, which may have dissolved some of the NO_x produced in the combustion of the offgas will be a very small flow. However, all scrubber circuit blowdown is directed to the process water tank for re-use within the Plant.

The transport of coal from Queensland is unsustainable due to high transport costs, increased production of greenhouse gas and in transit hazards especially within the marine environment.

The supply of coal from Queensland is currently the most sustainable as it results in the lowest CO_2 output per tonne of pig iron produced, the highest production output, lowest operating cost. It also provides the greatest confidence for use in the commercial Plant as it was the benchmark coal trialled in the HRDF.

The Proponent considers that the in transit hazards are of low risk and are manageable.

4.12.4 Shipping and Multiple Use

The Cockburn Sound Management Council stated that Fremantle Ports needs to provide information to support the statement that the proposal will not impact on the multiple uses of Cockburn Sound.

Fremantle Ports has advised that there are currently more than 16 ship visits to Cockburn Sound per week. The HIsmelt project will involve an additional 1 to 2 ship visits per week. With a transit time through Cockburn Sound to the jetty of approximately 30 minutes it is difficult to envisage any noticeable impact on the multiple uses of Cockburn Sound.

The Cockburn Sound Management Council states that the Proponent (or Fremantle Ports) needs to address the potential impact on increased mooring time on recreational boat users in Cockburn Sound.

There is no mention of the type of "parking time" and where the ships may be "parked".

Fremantle Ports has advised that should the need arise for ships to go to anchor, ship operators will seek to minimise costs (by avoiding the need to duplicate pilotage services) and anchor in Gage Roads. The alternative points will be those currently used by grain ships.

4.13 VISUAL AMENITY

The Town of Kwinana stated that considering the industrial nature of the area and surrounding land uses the overall aesthetic effect is considered to be reasonably low. However, all reasonable measures must be taken to ensure the Plant is designed to blend harmoniously into the surrounding environment.

The Proponent agree with the Town of Kwinana that the aesthetic impact of the Plant will be low. The Proponent will establish screening vegetation around the Plant site to act as a visual buffer.

The Cockburn Sound Management Council suggested that to assess the visual impact from an "on water" perspective from Cockburn Sound, a visual representation of the typical dust plumes expected to be generated by the project during bulk loading and unloading operations would be appropriate.

The Plant will be no more obtrusive for those using Cockburn Sound than is posed by the existing industries in the Kwinana Industrial Area.

The management of dust during unloading operations is addressed in Response 4.5.2.

4.14 SITE SELECTION

The criteria for the decision to site the Plant in Kwinana is questioned on a number of grounds:

1. *Prevailing SW winds blow pollution to Perth CBD.*
2. *Uses large amount of water.*
3. *Increases pollution from the Kwinana Industrial strip.*
4. *Extra greenhouse emissions.*
5. *Pollutants from the Plant will be carried across Kwinana, Wattleup and Hope Valley which are residential areas.*
6. *Cancer rates in communities close to industrial strip are greater than for other Metropolitan suburbs.*

The PER states that the Kwinana site was the worst of the eight possible locations for environmental and social impacts and was chosen due to economic factors. Environment and health should be paramount as part of the decision making process.

No effort was made to consider sites nearer the source of iron ore which would have the advantage of reduced transport and handling costs and the reduction of environmental pollution in Kwinana.

The Kwinana site for the Plant was chosen by the Proponent for economic reasons such as cheaper labour and infrastructure costs. However, the threat to the health of the surrounding communities posed by this plant should be given priority over economic factors.

The EPA Service Unit states that in regard to siting of the plant, given that the source materials have to be imported from great distances, and the product then has to be exported great distances, the argument for choosing Kwinana as the preferred site for the proposal appears to be thin. How does the proponent respond to this concern?

As stated in the PER (Section 3.2) the Proponent investigated a number of potential locations for the HIsmelt Plant based on their suitability and an economic perspective. The Pilbara was ruled out as being an economically feasible location for a Plant of the size proposed due to:

- higher labour costs;
- the costs of construction camps;
- the requirement for a desalination plant ; and
- the necessity to construct wharf facilities for the receival of coal shipments.

The current lack of infrastructure in the Midwest region was a major barrier to establishing the Plant at Oakajee.

The two locations which remained economically feasible were Kwinana and Bunbury. These loactions were then further investigated with subjective assessments being undertaken by HIsmelt personnel. Kwinana was found to be the preferred site due to:

- the ability to use the existing HRDF plant;
- the site being already cleared and located in the KIA, which is recognised as the State's major heavy industrial area;
- there is an existing bulk material handling operation neighbouring the HIsmelt site;
- construction labour can be sourced from the metropolitan area so a construction camp will not be required; and
- there is an enormous potential for synergistic relationships with other industries in Kwinana thereby complying with the objectives of sustainability.

The Proponent recognised that the "social and environmental constraints" in the Kwinana area are medium to high and higher than other areas. This does not imply that the environmental impacts in Kwinana would be greater. In fact the Proponent is required to implement more stringent environmental management measures than may be the case for other sites.

The social and environmental constraints recognised by the Proponent in Kwinana include factors such as the:

- Environmental Protection (Kwinana) (Atmospheric) Wastes Policy (EPP) which defines limits and standards for SO_2 and particulates.
- Industry in Kwinana has maximum permissible quantity emission rates allocated to them under the EPP.
- Draft Cockburn Sound Environmental Protection Policy (EPP) and the draft Environmental Management Plan (EMP) for Cockburn Sound and its Catchment.
- Cumulative impact of the Project with other industries in terms of air emissions and noise.
- Proactive community groups who tend to oppose further industry in Kwinana.

4.15 COMMUNITY INVOLVEMENT

Environmental Management Plans should be available as part of the PER process. The public needs an opportunity to review and comment on the Plans.

The Cockburn Sound Management Council requested that the Council have an opportunity to comment on the Management Plans.

Environmental Management Plans (EMP) will be prepared for the Construction and Operational Phases of the Project. The EMPs will document the management activities to be undertaken to ensure the Proponent's environmental objectives are met. EMPs are best prepared close to final design stage when the Plant design and operations are being finalised. It should be noted that the EMPs will be evolving documents and will be further defined and integrated into the Environmental Management System (EMS) to be prepared for the Proponent's operations.

As stated in the PER (Section 7.2.1) the Construction EMP will be prepared and submitted to the DEWCP, who administers the CSMC, for approval prior to the commencement of construction. The Construction EMP will include the specific management for:

- Contractors.
- Incident Reporting.
- Dust.
- Noise.
- Waste Disposal.
- Groundwater.
- Stormwater Runoff.
- Erosion.
- Transport.
- Safety.

The Construction EMP will also be made available to the community on the HIsmelt web site www.hismelt.com and at the DEWCP and local libraries.

The EMPs for operations will be prepared in conjunction with the engineering design and operations' teams. This will ensure that there is an understanding, between those designing the Project and those who will be implementing the operations, on the environmental management to be incorporated in the EMPs.

In addition to a Plan for general site environmental management, the Operational EMP will also comprise specific Management Plans for:

- Atmospheric Emissions.
- Dust.
- Noise.
- Surface Water.
- Groundwater.
- Hazardous Materials.
- Solid Waste.
- Wastewaters.
- Transport of Materials.
- Decommissioning and Closure.
- Safety.

Each of the Management Plans will be prepared and submitted to the DEWCP as part of the EMP for the site prior to the commencement of operations. The Plans will also be made available to the community on the HIsmelt web site www.hismelt.com and at the DEWCP and local libraries.

The residents of Kwinana have no effective voice in the (EPA) decision- making processes.

The HIsmelt Project is subject to a formal environmental assessment by the EPA. The Proponent undertook an extensive community consultation programme during the preparation of the PER. This included meeting with local groups and interested individuals, and workshops held in both Kwinana and Rockingham to ensure that the Proponent obtained input from the general community. The Proponent documented the issues raised during the consultation and addressed them in the PER.

In addition to the consultation discussed above, the PER was available for a four week public review period at which time the EPA sought submissions from the community on the PER. This document contains the Proponent's response to the issues raised in the submissions.

Therefore the community does have an effective voice in the decision –making process in two ways. Firstly, the Proponent in developing the Project considers all the issues raised by the community. Secondly the EPA and the regulatory authorities take into consideration the content of the submissions whilst undertaking the assessment and imposing environmental conditions.

The community should be consulted on the proposed management plans.

The Proponent will make the Management Plans publicly available on the HIsmelt web site and at the DEWCP and local libraries.

The community should have access to all monitoring data and have involvement in annual auditing and verification process.

It is expected that the licence conditions will stipulate the monitoring and reporting requirements for the site. The Proponent will make the monitoring data publicly available by placing it on the HIsmelt website.

Auditing requires trained, skilled and professional auditors for the process to be verifiable. HIsmelt (Operations), as part of the Rio Tinto Group, will be subject to regular Rio Tinto audits which are undertaken by experienced personnel external to the site. The DEWCP will also undertake regular audits of the site and operations to ensure that the Proponent is in compliance with the Ministerial and licence conditions.

4.16 EMPLOYMENT

The Town of Kwinana states that the indirect employment of local service contractors and personnel is beneficial to the local community.

Employment will not be increased by the Project. HIsmelt could not guarantee to employ local labour and skills in preference to outsiders or outside contractors. The Project will not produce any real jobs for locals. There will only be 65 jobs with people employed form other states.

The 65 jobs mentioned in the PER (Section 4.22) are direct fulltime positions. However, the total employment impact of the Project is much greater.

The Kwinana Industrial Area Economic Impact Study (Sinclair Knight Merz, 2002) was referred to in Section 8 of the PER. The Economic Study quantifies the multiplier effects of both direct employment and capital investment. It estimates that the impact of multiplier effects is such that the 3636 people directly employed by Kwinana Industries translates into a total of 24,397 jobs directly or indirectly dependent on the operations at Kwinana (a multiplier effect of 6.7). Applying this same number to the Project results in between 402 and 435 jobs being created.

The Economic Study states that for capital expenditure in the chemical or process industries, roughly 70% is expended in Western Australia. This will certainly be true for the HIsmelt Project, with local workshops to be used for the fabrication of most equipment modules. The Study states that annual capital expenditure by Kwinana Industries averages $300 million and results in 3,100 ongoing jobs. If both Stage 1 and 2 HIsmelt Plants are constructed by 2008 it will have represented an average capital expenditure of around $160 million per year over a five year period. This translates to 1650 jobs on an ongoing basis over that period.

The KIA Economic Study found that 70% of the employees of Kwinana Industries lived in the Cockburn, Kwinana and Rockingham area. There is no reason to suggest that the statistics for the proposed Plant would be any different.

As stated in the PER most of the larger equipment modules will be fabricated off site. It is envisaged that this fabrication will be undertaken in local workshops. This will have direct benefits to local small to medium businesses in the area, and the short distance required to transport the plant will minimise the impacts on traffic.

5. ISSUES RAISED IN SUBMISSIONS REQUIRING RESPONSE FROM GOVERNMENT AUTHORITIES

Some issues raised in the submissions on the HIsmelt PER were not directly related to the Hismelt Project or the Proponent. Many of these requested a response from the Government authorities. These have been listed below as part of the Summary of Submissions.

The Town of Kwinana "requested responses from either the DEWCP or the EPA in regards to the following statements:

A) Air Emissions – Council requested that it be consulted prior to any downgrading of monitoring programs, Council would expect that a decision to reduce the frequency of any monitoring be comprehensively justified.

B) How will future development within the Kwinana Industrial Area be accommodated once the volume of SO_2 gets close to the EPP Limit?

C) Request evidence be provided to confirm that technology used in the management of airborne particulates from the Plant doses in fact represent best available technology.

D) Council requests the EPA to facilitate a study of the levels of dioxins, furans, PAH's , VOC's and heavy metals emitted from the Kwinana Industrial Area with the cooperation of KIC, DEP and Kwinana Industries. The study should predict cumulative levels of these and similar emissions within residential areas.

E) How are emissions from ores that are to be trialled at HIsmelt going to be covered by the DEWCP licence?

F) If in the future, HIsmelt wishes to use ores that have not been assesses through the PER process the DEWCP or EPA should, consult with all stakeholders.

G) Once a site is identified for the slag processing facility the process and act8vites on the site should be assessed by DEWVCP to ensure that off site impacts are acceptable. Council requests that it be consulted through this assessment process.

H) As a safeguard, groundwater monitoring bores should be located downstream of all feedstock and storage stockpiles to ensure early detection of pollution results from these monitoring bores should be reported to the Town of Kwinana and DEWCP on a six monthly basis.

I) Request the DEWCP or EPA to explain why a multi-pathway exposure and health risk assessment was not required for the HIsmelt PER.

J) Request that details of the environmental management plans referred to in the PER including: construction, surface water runoff, groundwater monitoring, waste, waste water discharge, in addition to the Environmental Management System and Plan; be considered as part of the Public Environmental Review Process."

The following comments are from Submissions from community groups or individuals.

There is a lack of trust in the DEP and EPA as they only produce guidelines for Australian Standards and apply them to individual industries and not industries combined in the same area at the same time.

The community has little or no faith in the EPA's ability to protect our environment and amenity. The EPA comes across as nothing but an ineffectual advisory body that has chosen to hide whatever is left of the teeth it has!

The EPA must admit that the licence levels for current emissions are far, far above what is required by modern industry and that fact must be reflected in a reduction of allowable limits in the Kwinana Air Quality Buffer Zone!

The EPA and the WA Government need to reconsider whether high greenhouse gas emitting industry is the kind of development that is in the best interests of WA.

It is requested that the EPA and DEWCP urgently conduct a study (or order a study to be conducted) into the existing toxic pollutant levels in the Kwinana air shed (including the buffer zone) and ensure that sufficient knowledge and understanding is gained on what effects cumulative industrial emissions are having to the health of residents in the region.

It is requested that the government urgently commissions a Health Impact Assessment for the cumulative impact of existing Kwinana Industry.

It is requested that the EPA/DEP review and revise the Kwinana Air Shed EPP to include up to date state of knowledge information, guidelines and limits that are sufficient to protect public health.

It is requested that the DEWCP commence (or order) monitoring of Particulates PM2.5, not just PM10 that is officially recognised and monitored in the Kwinana region.

6. PROPONENT'S MANAGEMENT COMMITMENTS

To ensure that all of the environmental issues associated with the Project are managed, resulting in an environmentally sound Project, the Proponent has made management commitments, which were presented in Section 11 of the PER.

The Proponent has revised the format of the Environmental Management Commitments upon request from the DEWCP. The DEWCP requested the changes be made to comply with its current approach to ensuring the management commitments are readily auditable. The revised Proponent's Commitment Table is presented in Table 6.1.

Table 6.1
Summary of Proponent's Environmental Management Commitments
Commercial HIsmelt Plant Kwinana

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
1	**General Environmental Management**	To ensure that that any potential environmental impacts associated with the construction and operations of the Project are minimised or ameliorated.	Prepare and submit an Environmental Management Plan (EMP) for the site, which will include Plans for the following: • Construction • Atmospheric Emissions • Greenhouse Gas Emissions • Dust • Noise • Surface Water • Groundwater • Hazardous Materials • Solid Waste • Wastewaters • Transport of Materials • Decommissioning and Closure • Safety Make the above Management Plans available on the HIsmelt web site and at the DEP and local libraries.	Construction EMP (CEMP) - Prior to construction. Prior to commissioning	DEP

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
2	**General Environmental Management**	To ensure that that any potential environmental impacts associated with the operations of the Plant are managed and minimised.	Prepare an Environmental Management System (EMS) for the operations of the HIsmelt Plant. The EMS will include elements such as: • Identification of issues. • Management measures. • Training and communication. • Key performance indicators. • Measuring and corrective actions. • Record management. • Programme of review. • Means for continual improvement. • Policy. • Emergency preparedness and response. Implement the EMS.	Prior to commissioning. During commissioning and operation.	
3	**Construction**	To ensure that appropriate environmental management measures are incorporated in the construction phase of the Project.	Prepare and submit a Construction EMP for the Project, which will include specific management for: • Contractors. • Incident reporting. • Dust. • Noise. • Waste Disposal. • Groundwater. • Stormwater runoff. • Erosion. • Transport. • Safety. Implement the Construction EMP.	Prior to construction. During construction.	DEP

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
4	**Atmospheric Emissions**	To ensure that gaseous and particulate emissions, from the Plant do not cause ambient ground level concentrations to exceed appropriate criteria, including the Kwinana EPP and the NEPM standard for Air Quality.	Prepare an Atmospheric Emissions Plan which will include the specific management, monitoring, reporting requirements and measures to be undertaken if exceedances occur for the following parameters: • Sulphur dioxide. • Particulates. • Nitrogen oxides. • Carbon monoxide. • Dioxins and Furans. • Heavy metals. • Volatile organic compounds, Polyaromatic hydrocarbons, Persistent organic pollutants. • Odour. Implement the Atmospheric Emissions Plan.	Prior to commissioning During operations.	DEP
5	**Sulphur Dioxide**	To ensure that emissions of SO_2 from the Plant are managed and monitored so that they are below the maximum permissible levels.	The Proponent will: • incorporate a Flue Gas Desulphurisation System in the Plant design that is considered Best Available Technology at the time of Plant design; • install a continuous monitoring instrument to measure SO_2 emissions in the gas stream exiting the main stack of the Plant; and • report monitoring data for SO_2 to the DEP on a monthly basis, and annually as part of the National Pollutant Inventory (NPI).	Prior to commissioning and during operation.	DEP
6	**Particulates**	To manage and minimise the emissions of airborne particulates from the Plant, and to ensure that the ground level concentrations resulting from these emissions are below the relevant Environmental Protection Policy (EPP) and National Environmental Protection Measure (NEPM) standards.	The Proponent will: • incorporate scrubbers and bag filters that are considered Best Available Technology at the time of Plant design; • measure particulate emissions from the Plant stacks on, as a minimum, a six monthly basis; and • report particulate monitoring data to the DEP on, as a minimum, a six monthly basis.	Prior to commissioning and during operation.	DEP

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
7	**Nitrogen Oxides**	To ensure that NO_X emissions from the Plant are minimised and that ground level concentrations resulting from these emissions comply with the NEPM standard in residential areas.	The Proponent will: • incorporate burners that are designed to keep NO_X emissions as low as reasonably practicable where process gas will be combusted, and low NO_X burners where natural gas will be combusted in the Plants; • sample and analyse the gas stream exiting the main stack for NO_X emissions on, as a minimum, a six monthly basis; and • report monitoring data for NO_X emissions to the DEP on, as a minimum, a six monthly basis, and annually as part of the NPI.	Prior to commissioning and during operation.	DEP
8	**Carbon Monoxide**	To ensure that emissions of carbon monoxide from the Plant do not result in an exceedance of the NEPM standard in residential areas.	The Proponent will: • sample and analyse the gas stream exiting the main stack of the Plant for CO emissions on, as a minimum, a six monthly basis; and • report monitoring data for CO emissions to the DEP on, as a minimum, a six monthly basis, and annually as part of the NPI.	During operation.	DEP
9	**Dioxins and Furans**	To ensure that the offgas handling system employed in the Plant does not allow dioxins and furans to be emitted.	The Proponent will: • sample and analyse the offgas emissions, in accordance with an agreed standard based on international best practice, during commissioning and the subsequent operation to establish if there are any Dioxins or Furans present; • provide monitoring results for Dioxins and Furans to the DEP as they are received; and • review future monitoring of the offgas emissions for Dioxins and Furans in conjunction with DEP as the results of the monitoring are being assessed.	During commissioning and operation.	DEP

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
10	**Poly Aromatic Hydrocarbons (PAHs) and Volatile Organic Compounds (VOCs)**	To ensure that there are no significant concentrations of PAHs and VOCs emitted to the atmosphere in the offgas from the Plant.	The Proponent will: • sample and analyse the offgas emissions, in accordance with an agreed standard based on international best practice, during commissioning and the subsequent operation to establish if the concentrations of PAHs and VOCs are at or above the Trigger Levels; • provide monitoring results for the PAHs and VOCs to the DEP as they are received; and • review future monitoring of the offgas emissions for PAHs and VOCs in conjunction with the DEP as the results of the monitoring are being assessed.	During commissioning and operation.	DEP
11	**Heavy metals**	To ensure that there are no significant concentrations of heavy metals emitted to the atmosphere from the Plant.	The Proponent will: • sample and analyse the offgas emissions, in accordance with an agreed standard based on international best practice, during commissioning and the subsequent operation to establish if the concentrations of heavy metals are at or above the Trigger Levels; • provide monitoring results for the heavy metals to the DEP as they are received; and • review future monitoring of the offgas emissions for heavy metals in conjunction with the DEP as the results of the monitoring are being assessed.	During commissioning and operation.	DEP
12	**Odour**	To ensure that any odours emanating from the Project do not adversely affect the welfare and amenity of other land uses.	The Proponent will implement measures to minimise the potential for odours to be produced or released to the environment.	During commissioning and operation.	DEP
13	**Greenhouse**	To minimise greenhouse gas emissions per unit of product, and implement measures for greenhouse gas management.	Prepare and implement a Greenhouse Gas Emissions Management Plan.	Prior to the commencement of construction	DEP

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
14	**Greenhouse**	To minimise greenhouse gas emissions per unit of product, and implement measures for greenhouse gas management.	As part of the Rio Tinto Group, the Proponent will: • continue to participate in the Australian Greenhouse Office Greenhouse Challenge Programme; • will participate in the research and development of new technologies that will result in a reduction of greenhouse emissions such as coal gasification and hydrogen production; and • calculate annual greenhouse gas emissions from the Plant and report the findings to the DEP. The Proponent will continue to investigate opportunities for offsetting the greenhouse gas emissions from the Project	Ongoing.	
15	**Dust**	To minimise dust generation from Project operations, and to ensure that dust levels from the site are within Kwinana EPP and NEPM standards and limits, meet the agreed criteria and do not unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person.	Prepare and submit a Dust Management Plan, which will include: • measures for controlling dust emissions; • monitoring programme; • reporting requirements; and • remediation measures if exceedances of the criteria occur. Implement the Dust Management Plan.	Prior to commissioning During operations.	DEP
16	**Noise**	To ensure that noise levels from the Project operations comply with the *Environmental Protection (Noise) Regulations, 1997.*	Prepare a Noise Management Plan, which will include: • noise attenuation measures; • surveys and monitoring; and • reporting. Implement the Noise Management Plan.	Prior to commissioning. During operations.	DEP/ Kwinana Industries Council
17	**Noise**	To ensure that the predicted noise level from the Plant is included in the cumulative noise study for the Kwinana industries.	Consult with the Kwinana Industries Council (KIC) on the findings of the regional noise survey. Provide results of the noise monitoring and modelling to the Kwinana Industries Council for inclusion in the Kwinana Noise model.	Prior to and during operations.	KIC

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
18	**Surface Water Runoff and Wash Waters**	To ensure that surface water runoff and washwaters are managed and do not impact on the environment.	Prepare and submit a Surface Water Management Plan, which will include the management for both clean stormwater runoff and for potentially contaminated runoff and washwaters. Implement the Surface Water Management Plan.	Prior to commissioning.	DEP
19	**Groundwater**	To ensure that groundwater beneath the site is not adversely impacted by the Project.	Prepare and submit a Groundwater Management Plan, which will include: • procedures for the protection of groundwater; • details of the ongoing, and extended, groundwater monitoring programme undertaken on the site to identify any significant changes in the groundwater; and • procedures for reviewing the monitoring programme, and parameters monitored, in conjunction with the DEP. Implement the Groundwater Management Plan.	Prior to construction.	DEP
20	**Hazardous Materials**	To ensure that the handling, storage and disposal of hazardous materials related to the Project does not result in impacts on the environment or people.	Prepare and submit a Hazardous Materials Management Plan, which will include: • procedures for maintaining an inventory of hazardous materials; • storage and handling requirements; and • emergency response. Implement the Hazardous Materials Management Plan.	Prior to commissioning. During operations.	DEP/ MPR
21	**Waste Management**	To minimise, re-use or recycle wastes where practicable and to ensure that any wastes requiring disposal are disposed in an environmentally acceptable and approved manner.	Prepare and submit a Waste Management Plan based on the principles of Reduce, Recycle and Re-use. Implement the Waste Management Plan.	Prior to commissioning. During operation.	DEP
22	**Process Wastewaters**	To ensure that there is no adverse impact on the environment from the storage and if necessary disposal of process wastewaters.	Prepare and submit a Wastewater Management Plan, which will include the management, monitoring and reporting of process wastewaters. Implement the Wastewater Management Plan.	Prior to commissioning. During operation.	DEP/ Water Corporation

Table 6.1 (contd)

Number	Topic	Environmental Objective	Action (Commitment)	Timing	Advice
23	**Sewage**	To ensure that an appropriate sewerage system is installed on site to minimise the potential for nutrients from the sewage to enter the environment.	Install appropriate Nutrient Retentive Sewerage Systems on the site.	During construction	Department of Health/ Town of Kwinana
24	**Site Contamination**	To ensure that any existing on-site contamination is managed, and that further contamination from Project operations is avoided.	Undertake a Stage II Site assessment to identify on site contamination.	Prior to construction	Landcorp/ DEP
25	**Community**	To ensure that the community is consulted during development, construction and operation of the Plant.	Continue to liaise with the community and other stakeholders during the development, construction and operation of the Plants.	During the development, construction and operation of the Plant.	
26	**Visual Amenity**	To minimise the impact of the Plant on visual amenity.	Establish screening vegetation around the Plant site to act as a site buffer.	During construction and operations.	
27	**Risk and Hazards**	To ensure that the Plant is designed, constructed and operated in a safe manner, and that the Project operations undertaken are non- hazardous.	The Proponent will: • undertake HAZOP studies as part of the design, construction and operation of the Plants which will be submitted to the MPR; • prepare Site Safety Management Plans, as part of the Project Management Plan for the site, which will be submitted to the MPR; and • develop Emergency Response Procedures, which will include the establishment and maintenance of an Emergency Response Team. The Procedures will be provided to the Kwinana Industries Mutual Aid group. The Proponent will ensure that the operator of the Air Separation Unit analyses for hydrocarbons and CO_2 at appropriate locations within the ASU.	Studies will be undertaken during the design, construction and operation of the Plant. Plans prepared prior to construction and commissioning. During Plant operations.	MPR
28	**Decommissioning and Closure**	To ensure that the Plant is properly decommissioned and the site is left in a safe and acceptable manner.	The Proponent will: • prepare and regularly update a Closure Plan in accordance with Rio Tinto's requirements; • prepare a Decommissioning Plan which will be submitted to Rio Tinto and DEP prior to closure; and • decommission and close the Plant site in accordance with the regulatory requirements at the time.	Prior to closure	DE P

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Appendix A

Assessment of Human Health Issues

HIsmelt Operations Pty Limited

Commercial HIsmelt® Plant
Kwinana Western Australia

Assessment of Human Health Issues

August 2002

corporate environmental CONSULTANCY PTY LTD
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Assessment of Human Health Issues

Commercial HIsmelt® Plant
Kwinana, Western Australia

HIsmelt (Operations) Pty Limited

1. INTRODUCTION

HIsmelt (Operations) Pty Limited (the Proponent), acting as the manager on behalf of an unincorporated Joint Venture, proposes to construct and operate a Commercial HIsmelt® Process Plant (the Plant) at Kwinana in Western Australia. The Plant, the associated facilities and operations are referred to as the Project. The Plant will be located at the site occupied by the existing HIsmelt Research and Development Facility (HRDF) within the Kwinana Industrial Area (KIA), 40km south of Perth.

The Project is being assessed under the Western Australian *Environmental Protection Act, 1986.* The Proponent prepared a Public Environmental Review (PER) (HIsmelt Operations/ Corporate Environmental Consultancy, 2002) which was available for public review between 22 April and 20 May 2002. During this period the Environmental Protection Authority (EPA) invited submissions from government agencies and the public to help them prepare an assessment report in which it will make recommendations to Government.

One issue raised in some of the submissions was related to health risks and the impact of the Project emissions on the health of the community. Health is determined by many factors including genes, age, a person's social and economic circumstances, lifestyle and access to services, as well as environmental health factors such as air and water quality, housing etc. A health assessment seeks to ensure that both the positive and negative impacts on health (as viewed from a wider perspective than just physical illness or injury) are effectively considered during impact assessment (enHealth, 2001).

The Proponent has responded to the specific questions, raised in the submissions, in the Response to Submissions document. In addition, the Proponent has responded to the requests for a health assessment by preparing this Assessment of Human Health Issues Report for submission to the Department of Health (Environmental Health Branch), the Department of Environment and Water Catchment Protection (DEWCP) (Air Quality Management Branch) and the EPA. The Assessment of Human Health Issues Report will be made public as a component of the Proponent's Response to Submissions.

2. SCOPE OF THE REPORT

The scope of the Assessment of Human Health Issues was discussed with the Department of Health, the DEWCP and the EPA Service Unit and it was agreed that the Proponent should:

- identify the potential pollutants that could be emitted from the Plant;
- discuss the likely impact of these pollutants on health;
- provide estimates of the predicted emissions, where feasible, and technical information to support the predictions;
- assess the levels under various scenarios, particularly the maximum (worst case) concentrations; and
- discuss the potential health impacts of the emissions at the level predicted.

Where information is contained in the PER the relevant sections will be referred to in this Report to avoid major duplication of the PER. The PER is available on the HIsmelt web site www.hismelt.com. However, some information contained in the PER will be reproduced in this Report, together with additional data, if it is considered beneficial to the discussion of the issue.

3. THE PROJECT

3.1 PROJECT OVERVIEW

The Project is described in detail in Section 4 of the PER. The Stage 1 Plant will be designed to process around 1.3 million tonnes per annum (tpa) of iron ore and 560,000 tpa of coal to produce around 820,000 tpa of pig iron using the HIsmelt® Process (The Process). If the Stage 1 Plant is found to be technically and commercially viable, it is proposed to install an additional Plant (Stage 2) to double production to around 1.6 Mtpa of pig iron. The Stage 2 Plant will be effectively a duplication of the Stage 1 Plant.

The Process is a reduction process that produces liquid iron hot metal by the smelting of iron ore or any other appropriate ferrous feed material. The smelting is undertaken in a molten iron bath using coal as the reductant and energy source. A process flow diagram is presented as Figure 3.1. A detailed process flow sheet has been provided separately and confidentially to the EPA due to the commercial sensitivity of the Process.

The principal raw materials required for the Process are iron ore fines, coal and fluxes (lime and dolomite). Iron ore will be shipped to Kwinana from Dampier, and railed from Koolyanobbing in Western Australia. Coal will be shipped from the east coast of Australia to Kwinana.

The core element of the HIsmelt® Process is a Smelt Reduction Vessel (SRV) (see Figure 3.2) which contains the molten iron bath into which ferrous feed material, coal and fluxes will be injected. The ore will be smelted in the SRV to produce molten iron and a slag that will contain the gangue. The use of a Hot Air Blast will result in hot gas (offgas) exiting the furnace. A Preheater module will use the thermal and chemical energy of a portion of the offgas to heat and partially reduce the iron ore fines prior to their injection into the SRV. This will improve the energy efficiency and productivity of the Plant and reduce the greenhouse gas emission rate per tonne of product. The remaining offgas will be used as a fuel, either to heat the hot blast stoves or in the Waste Heat Recovery system to generate steam and electricity.

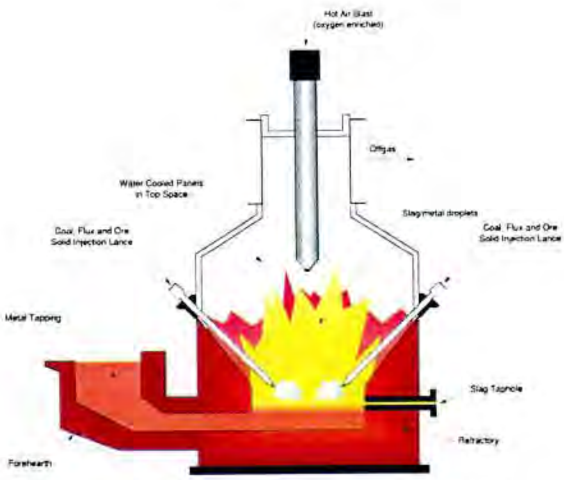


Figure 3.2 Conceptual Diagram of the Smelt Reduction Vessel

The pig iron product will be shipped for use in steel mills either within Australia or overseas. The unloading and loading of raw materials and product will be undertaken at the Fremantle Port Authority's (trading as Fremantle Ports) Kwinana Bulk Berth No.2 (KBB2). Fremantle Ports will be responsible for the unloading and loading shipping operations.

The Project will include a power generation facility that will utilise the offgas from the Process to generate electricity. Air Separation Units will also be constructed at the site to supply oxygen and nitrogen to the Plant. It is currently envisaged that the Air Separation Units will be built and operated by Air Liquide WA on the HIsmelt site. The proposed layout of the facilities on the site is presented in the PER.

3.2 EMISSION CONTROL

Emissions of pollutants from the Plant will be low due to the fact that :-

- the Process itself will not generate large quantities of polluting species due to the benign raw materials used and the process conditions; and
- a number of pollution control systems have been incorporated into the plant design to control those species that are generated.

The following discussion will demonstrate that the Process has a low potential to generate many of the polluting species commonly associated with Integrated Iron and Steel plants, and that emissions of those species that are generated will be kept as low as practicable through the application of Best Practicable Control Technology.

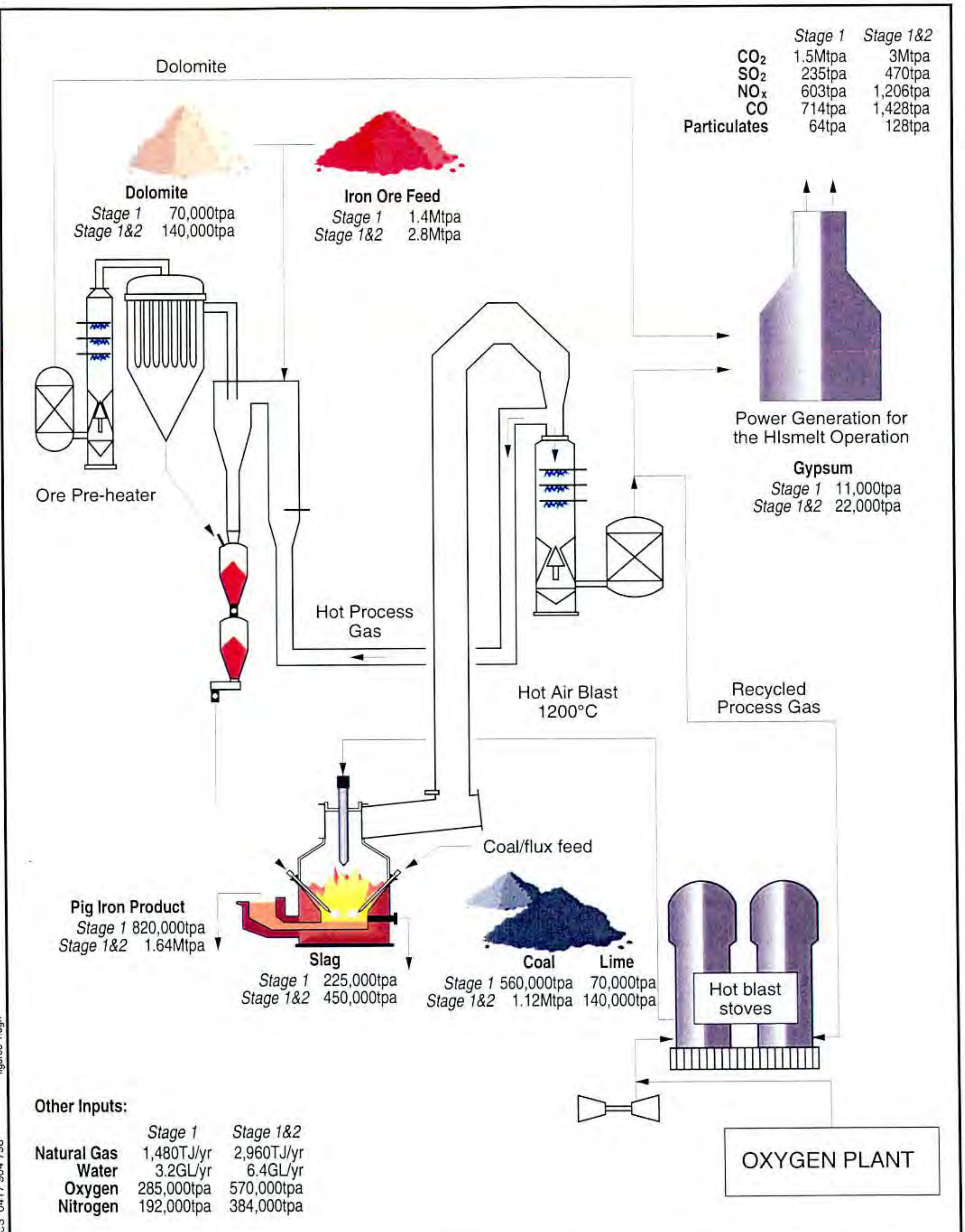
A detailed description of the HIsmelt Process® is presented in Section 4.8 of the PER. The following discussion will focus on those aspects of the Process that justify the conclusion that it is unlikely that certain species will be emitted from the Plant.

3.2.1 Coal in the Process

Coal injected into the Process will pass through and/or react in four different regions within the Smelt Reduction Vessel. These are:

- the plume at the end of the injection lances;
- pyrolysis and volatiles yield region;
- dissolution and capture of carbon by the bath; and,
- topspace where combustion occurs to supply energy for the system.

These regions are shown in Figure 3.3.



HIsmelt®

PROCESS FLOW DIAGRAM

Commercial HIsmelt Plant
ASSESSMENT OF HUMAN HEALTH ISSUES

Figure 3.1

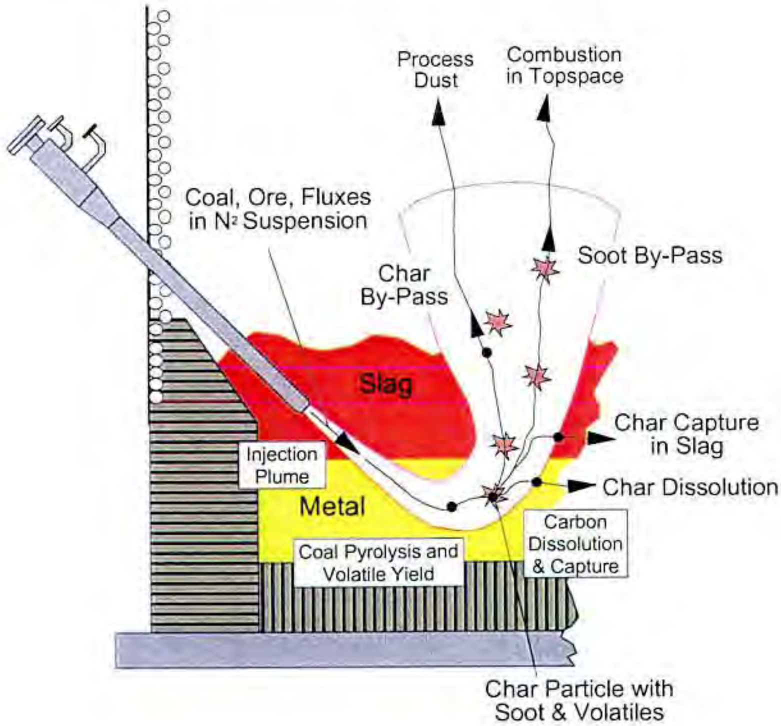


Figure 3.3 Coal Movements through the HIsmelt Process

Coal Pyrolysis

Coal comprises three components, fixed carbon, volatile matter (hydrocarbon) and ash. When pulverised coal is injected into the molten metal bath, the particles will be subjected to rapid heating and the volatile component will vaporise, termed pyrolysis, in fractions of a second (Orsten and Oeters, 1998). This pyrolysis of coal will produce H_2, CO, CO_2, N_2, and soot.

Carbon Dissolution

Due to the large volumes of gas that will be generated by reduction and by the pyrolysis of coal within the bath, the residence time of char and soot in these high velocity plumes will be short (Cusack *et.al*, 1994). Soot will be readily absorbed into molten iron. Due to the amount of gas that will be generated in the bath, a proportion will not have an opportunity to come into contact with liquid metal and will pass through into the topspace.

In general more ordered carbon arrangements, like graphite, have been experimentally found to have better dissolution characteristics than other carbon sources that are less structured. Apart from the type of coal used, sulphur within the melt decreases the dissolution of carbon. It has also been shown that sulphur has an effect on the wetting angle of char and iron with higher levels of sulphur leading to poorer wetting (Sahajwalla *et. al.*, 1994).

Experimental laboratory tests show that char is not wetted well by slag, which implies that the slag will capture only a small amount of soot and char.

Topspace Reactions

Due to the soot being ultra-fine, it will quickly react in the topspace where the temperatures will be in the range 1450 - 2600°C. The soot will not survive for more than a couple of milliseconds within this environment, as it is drawn into the combustion zone created by the Hot Air Blast jet.

Char particles will react with topspace gases, particularly oxygen. The reaction of char with oxygen will be several orders of magnitude faster than with CO_2 and H_2O. Some char will escape from the vessel and report to the offgas cleaning system.

The high temperatures and oxygen rich Hot Air Blast will rapidly decompose any hydrocarbons reaching the topspace. The reaction products - carbon (soot), hydrogen and carbon monoxide will be subsequently partially post combusted by further reaction with the Hot Air Blast.

Offgas System

A schematic diagram of the emissions control measures to be implemented in the Plant is presented as Figure3.4.

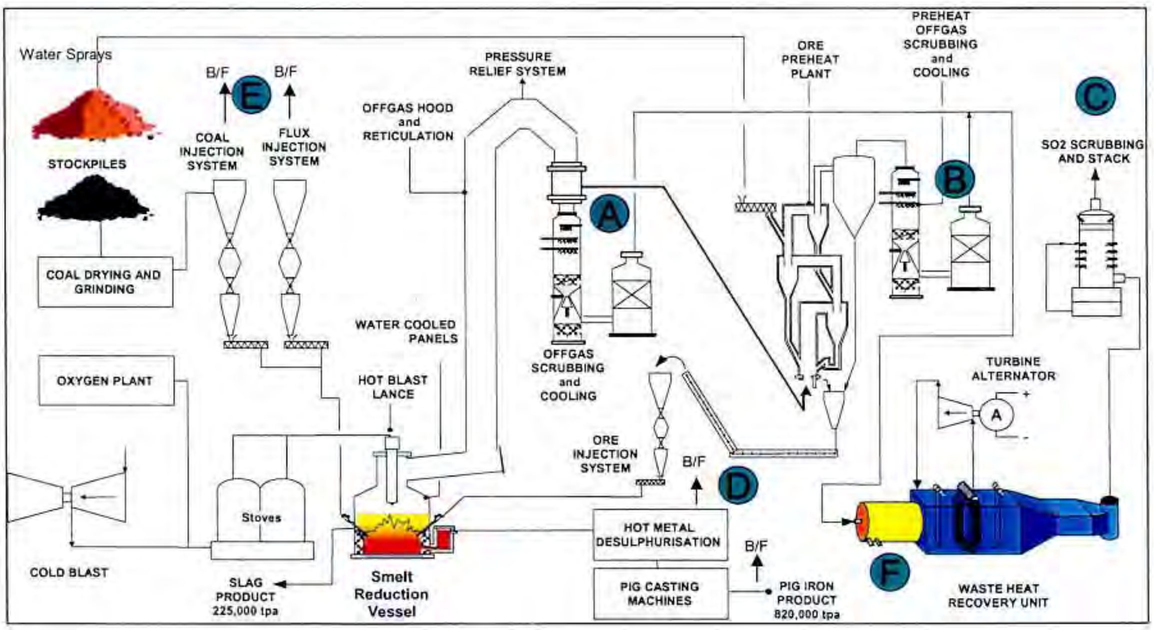


Figure 3.4 Schematic Diagram Showing Emission Control Measures

The offgas that leaves the SRV will have a temperature of approximately 1450°C, a chemical energy content of approximately 3.0MJ/Nm^3 (due to its CO and H_2 content) and a dust content between 10 and 20 g/Nm^3. This gas is the cooled to 1000°C in a water cooled duct (offgas hood), the heat that is removed being used to generate steam.

At the end of the offgas hood the gas stream will be split into two, with approximately half passing into the Preheater where it is used to preheat and pre-reduce the iron ore. The gas exiting the Preheater, which has a temperature of around 200°C, will then be scrubbed in a wet scrubber, (shown as B on Figure 3.4) prior to being used as a fuel in the Waste Heat Recovery (WHR) system.

The remainder of the offgas will pass into a wet scrubber (shown as A on Figure 3.4). In the scrubber the gas will initially be contacted with a large volume of water, delivered by a series of spray nozzles, which will quench the gas from 1000°C to 100°C in milliseconds. The contact of the gas stream with the water in this quench zone will also result in the removal of soluble species (such as alkalis, halides and some heavy metals) from the gas.

The lower portion of the scrubber will efficiently remove the particulate material. The gas stream will leave the scrubber containing less than 5mg/Nm^3 of particulates. The particulate material will be removed from the scrubber in a slurry stream that will flow to a clarifier where liquid/solid separation will take place. The clarifier underflow, containing the particulate material and some precipitated metal species (zinc, lead and cadmium sulphides) will then be filtered to produce a sludge that may be recycled back into the Process.

The gas that leaves the scrubber will be saturated with water vapour and will have a temperature of 90°C. It will be passed into a packed bed cooler where the temperature and water vapour content will be reduced by contact with water sprays. While this offgas cooler will not be designed to perform any scrubbing, it is probable that some additional particulate material and soluble species will be removed at this stage.

The cooled gas will then be suitable for use as a fuel in both the hot blast stoves and WHR system. The hot blast stoves will consume the quantity of gas required to attain the set point stove temperature whilst the remainder will be mixed with the Preheater offgas prior to combustion in the WHR system. The burners in both the stoves and WHR will utilise flue gas recirculation and staged combustion to ensure that there is complete combustion of CO and any residual VOC's (and PAH's) that may have remained in the gas stream, whilst minimising NO_x emissions (labelled F in Figure 3.4).

<u>Sulphur Dioxide</u>

The exhaust gas from the stoves and WHR are collected and passed through a Flue Gas Desulphurisation system (labelled C in Figure 3.4). The FGD uses lime to capture the Sulphur Dioxide in the gas resulting from the combustion of the H_2S. The FGD will have a removal efficiency of >95%. It is anticipated that particulate material that remained in the fuel gas stream will be removed in the FGD, resulting in the exhaust gas particulate concentration being <2mg/Nm^3.

Heavy Metals

Apart from iron (Fe), metals are present only at trace or minor levels in the raw material inputs to the process. Of the metals three are known to be volatile at the conditions experienced in the SRV, namely zinc, lead and cadmium, and hence will be present as metallic vapour in the offgas exiting the SRV. The potential therefore exists for these species to be released to atmosphere. Emissions of these species would be in the form of particulates. Thus the controls in place to limit particulate emissions from the main stack will also limit emissions of the heavy metals. As outlined above the wet scrubbers (A and B on Figure 3.4), the packed tower gas cooler after the scrubbers and the FGD (C on Figure 3.4) will be the control measures in place with an expected combined removal efficiency of 99.5% for particulates. This issue is further discussed in Section 4.12.2.

Particulate Material

Emission controls for process emissions of particulates have been discussed above.

Control measures will be implemented in other areas of the Plant to capture or control fugitive emissions of particulates. Induced draft fume capture hoods connected to Bag Filter systems will capture emissions from metal and slag tapping and casting operations as indicated at points labelled D in Figure 3.3. Silos and bins that are filled by pneumatic conveying of materials will vent to atmosphere through bag filter cleaning systems as indicated at point E in Figure 3.4.

Fugitive emissions from raw material storage and reclamation areas will be controlled by the use of water sprays.

3.2.2 Plant Start Up and Shut Down Procedures

Plant Start Up

The Plant Start Up Procedure from cold will involve the following steps :-

- Heat up by Hot Air Blast – a gradual heat up of the SRV and offgas system using hot air from the stoves diluted with ambient air to achieve the desired temperature.
- Once the desired temperature has been attained solid pig iron, coke and flux will be charged into the SRV.
- The charge materials will be melted using a combination of the Hot Air Blast and natural gas.
- Once a molten bath has been achieved raw material injection will be commenced starting with coal and lime, followed by iron ore.

The offgas from the start up period will pass through the scrubbers. It is expected that the emissions during this period will be within those levels predicted for normal operation.

Maintenance Shut Downs

The Plant will be subject to regular routine maintenance in order to ensure that the Plant's availability targets are achieved. The Plant will be taken offline for an eight-hour period each month to allow for maintenance of equipment that cannot be worked on while the Plant is in production mode. During such periods the injection of raw materials and the Hot Air Blast will be shut down but the molten iron bath will be left inside the vessel. Prior to the Plant being taken off line the slag will be tapped from the SRV.

During these shut down periods the Waste Heat Recovery system will be operated using natural gas as the fuel enabling steam and electrical power generation to continue at a level sufficient to allow equipment modules such as cooling water pumps, the ASU etc. to operate. The exhaust gas from the Waste Heat Recovery system will still pass through the Flue Gas Desulphurisation unit during these periods.

Bringing the Plant on line after a maintenance shut down will involve the injection of coal and lime together with the introduction of the Hot Air Blast. This procedure is referred to as a heating run as it raises the temperature of the molten iron bath. Ore will then be injected and production recommenced. The offgas from both the heating run and the subsequent gradual start of production will all be directed through the Waste Heat Recovery and the Flue Gas Desulphurisation systems so that emissions during maintenance shut downs are maintained at levels below those typical of normal operation.

Plant Shut Down

Plant shutdowns for an extended period of maintenance, greater than 8 hours duration, will involve shutting off raw material injection and the Hot Air Blast followed by the complete drainage of the metal and slag from the SRV. This shut down may result in the generation of an increased level of fume within the Core Plant building for a short period of time.

Plant Start Up after Emergency Trips.

There are a number of scenarios that can result in the Plant Control System initiating an emergency trip of the Plant during which raw material injection and the hot air blast will cease. If there is a delay in re-starting the Plant then start up may involve a heating run, as discussed above, which may lead to elevated SO_2 emissions as mentioned in Section 4.20.4 of the PER. The maximum predicted emissions from the Plants used for Air Quality modelling will coincide with such events.

4. ATMOSPHERIC EMISSIONS

4.1 GENERAL

Atmospheric emissions predicted for the Project are discussed in Section 4.20 of the PER. The issues and management related to emissions are discussed in Section 7.2 of the PER. The following sections identify the potential of pollutants, outline the health based comparison criteria, and discuss the health aspects of the predicted atmospheric emissions.

4.2 IDENTIFICATION OF POTENTIAL AIR POLLUTANTS

The emission control measures to be implemented in the Plant are discussed in Section 3.2. The predicted emissions of concern are tabulated in Table 4.1 together with applicable emission standards. It should be noted that the estimates of the heavy metal emissions in Table 4.1 are presented for the worst case maximum under a particulate scrubbing efficiency of 98.4%, and the expected efficiency of 99.4 %. The 98.4% efficiency estimate is based on a conservative estimate of 75% at each of the three scrubbing stages. However, it is believed that the first stage of wet scrubbing will achieve a minimum of 90% efficiency (particulate removal efficiency is 99.75%), which, if the efficiency of each of the other two stages is 75%, will result in an overall efficiency of 99.4%.

4.3 ENVIRONMENTAL PROTECTION (KWINANA) (ATMOSPHERIC WASTES) POLICY CRITERIA

The Kwinana region is covered by the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy (EPP). The EPP defines limits (concentrations of atmospheric wastes that shall not be exceeded) and standards (concentrations of atmospheric wastes that shall not be desirably exceeded) for sulphur dioxide (SO_2) and Total Suspended Particulates (TSP). The EPP Area is divided into the following three regions as shown on Figure 5.2 of the PER:

- Area A (Industrial) - the area of land on which heavy industry is located.
- Area B (Buffer Zone) - an area surrounding industry, plus other outlying land zoned for industrial use.
- Area C (Rural/Residential) - land beyond Areas A and B used predominantly for rural and residential purposes.

The limits and standards for the three areas are presented in Table 7.1 of the PER.

The EPP was established to "provide a basis for the establishment of ambient air quality objectives to protect the environment (including human health) in the municipalities of Cockburn, Kwinana and Rockingham and also provides a mechanism for effective achievement of sulphur dioxide and other objectives within the context of the multi- industry complex at Kwinana"(EPA, 1992).

Table 4.1 Potential Air Pollutants

Pollutant Species	Source	Emission Point	Relevant Standards		Predicted Maximum Levels from the Plant		Potential Health Effects from Exposure	Health Risk from Project (NR, L. M, H)
			Emission	Ambient at Residential Area	Emissions	Ambient Levels at Residences		
Dioxins	Process	FGD Stack	0.1ng/Nm³ [1]		<<0.1ng/Nm³ I-TEQ	Undetectable	Promotes Cancer	NR
Furans	Process	FGD Stack	0.1ng/Nm³ [1]		<<0.1ng/Nm³ I-TEQ	Undetectable	Promotes Cancer	NR
VOC's	Coal	FGD Stack			Negligible	Undetectable	Possible Carcinogens	NR
PAH's	Coal	FGD Stack			Negligible	Undetectable	Possible Carcinogens	NR
SO_2	Process	FGD Stack		**1 hour** 0.20ppm (NEPM)[2] 350μg/m³ (EPP)[3] 700μg/m³ (EPP)[4] **24 hour** 0.08ppm (NEPM) 125μg/m³ (EPP)[3] 200μg/m³ (EPP)[4] **Annual** 0.02ppm (NEPM) 50μg/m³ (EPP)[3] 60μg/m³ (EPP)[4]	35g/s	**1 hour** 34μg/m³ **24 hour** 5.6μg/m³ **Annual** 0.37μg/m³	Respiratory Illness	L
NO_2	Process	FGD Stack, Coal Mill Stack	**1 hour** 200μg/m³ **Annual** 40μg/m³	**1 hour** 0.12ppm (NEPM)[2] **Annual** 0.03ppm (NEPM)[2]	42g/s	**1 hour** 75μg/m³ **Annual** 1.35μg/m³	Respiratory Illness	L
CO	Process	FGD Stack, Coal Mill Stack		**8 hours** 9.0ppm (NEPM)[2]	250mg/Nm³	**8 hours** 13.5μg/m³	Cardiovascular Illness	NR
Particulates (TSP PM_{10}, $PM_{2.5}$)	Process	Main Stack Fume Extraction Stack #1 Fume Extraction Stack #2 Silo Vent Filters	100mg/m³ (NSW EPA)[5]	**TSP** 15 minute 1000μg/m³ (EPP)[3] 24 hour 90μg/m³ (EPP)[3] **PM_{10}** 24 hour 50μg/m³ (NEPM)[4]	0.2g/s (1.82 mg/m³) 1.45g/s (30 mg/m³)	**TSP** 15 minute 25μg/m³ 24 hour 2.1μg/m³ **PM_{10}** 24 hour 2.1μg/m³	Respiratory Illness	L

Table 4.1 Potential Air Pollutants

Pollutant Species	Source	Emission Point	Relevant Standards		Predicted Maximum Levels from the Plant		Potential Health Effects from Exposure	Health Risk from Project (NR, L. M, H)
			Emission	Ambient at Residential Area	Emissions	Ambient Levels at Residences		
Metals [8]	Raw							
Fe	Materials	Metal, Slag, Dust			0.4mg/Nm^3		Dependent on the Level – Fe and Zn are actually beneficial to human health at some levels - while others are toxic above a threshold level.	L
Zn		FGD Stack, Dust, Metal, Slag			330μg/m^3 (98.4% scrubbing efficiency) 124μg/m^3 (99.4% scrubbing efficiency)			L
Pb		FGD Stack, Dust, Metal, Slag	140μg/m^3 (USEPA)[6]	**Annual** 0.50μg/m^3 (NEPM)[4]	15μg/m^3 (98.4% scrubbing efficiency) 6μg/m^3 (99.4% scrubbing efficiency)		The toxicity is often a result of accumulated levels in the body rather than due to a single exposure.	L
Cd		FGD Stack, Dust, Metal, Slag	20μg/m^3	**Annual** 5ng/m^3 (WHO)	<1μg/m^3			L

Notes: NR – no risk L – low risk M – medium risk H – high risk
I-TEQ - toxic equivalent
1. Accepted European standard for incinerators.
2. Environmental Protection(Kwinana) (Atmospheric Wastes) Policy (1992)– Ambient Standards
3. Environmental Protection(Kwinana) (Atmospheric Wastes) Policy (1992)– Ambient Limits
4. National Environmental Protection Measures for Ambient Air Quality (1998).
5. NSW EPA (1997) emission standard.
6. USEPA (1999) Emission Standards for Hazardous Waste Combustors.
7. World Health Organization Air Quality Guidelines for Europe (2000)..
8. Ore and Coal may contain other heavy metals such as Mn, Cr, Ti, As, Ni, Cu, Co, Mo, Sn, V however, there is a very low potential for these metals to be emitted to the atmosphere from the Process. Thermodynamic principles and experience from iron and steel mills show that these metals report to the slag and metal.

4.4 NATIONAL ENVIRONMENT PROTECTION MEASURES STANDARDS

The National Environment Protection Council (NEPC) set standards for SO_2, PM_{10}, NO_2, ozone, CO and lead, referred to as criteria pollutants, in its NEPM for Ambient Air Quality (NEPC, 1998). The standards are considered to be the "first step in developing a more consistent national approach to air quality management so that Australians can enjoy equivalent protection from the adverse health impacts of air pollution."

The NEPM standards were developed by experts following a review of scientific literature to determine the potential health impacts of the six criteria pollutants. The experts identified concentration ranges necessary to protect public health. The work drew largely on epidemiological studies, which were supplemented by controlled human exposure studies. Consideration of the concentrations at which health effects occur and the concentrations that are realistically achievable were used to propose a set of standards and a ten year goal (1998-2008) for meeting them (NEPC, 2000).

4.5 SULPHUR DIOXIDE

The guidelines for sulphur dioxide, which have been considered in arriving at the levels stated in the Kwinana EPP, are shown in Table 4.2.

Table 4.2

Guidelines for Ground Level Concentrations of Sulphur Dioxide

for Specified Averaging Periods (μg/m³).

Guidelines	1 -hour	24-Hour	Annual
NHMRC/ANZEC[1] goals	700		60
EPA of Victoria - acceptable level[2] - detrimental level[3]	486	171 314	
World Health Organisation[4]	350	125[5]	50[5]
United States EPA - primary standard		365[6]	80

Source: EPA, 1992

1. NHMRC/ANZEC – National Health and Medical Research Council / Australia and New Zealand Environment Council.
2. Acceptable level is not to be exceeded on more than three days per year.
3. Detrimental level is not to be exceeded.
4. WHO Air Quality Guidelines for Europe, 1987.
5. Based on combined exposure to sulphur dioxide and particulate matter.
6. Not to be exceeded more than once per year.

The compliance criteria from the EPP and NEPM for ambient SO_2 levels in residential areas are shown in Table 4.3.

Table 4.3

Criteria for Ambient Sulphur Dioxide Concentrations

Averaging Period	NEPM Maximum Concentration		EPP Area C (Residential)	
	ppm	µg/m³	Standard (µg/m³)	Limit (µg/m³)
1 hour	0.20*	570	350	700
24 hour	0.08*	228	125	200
Annual	0.02	57	50	60

Note * 1day per year maximum allowable exceedance goal within ten years.

To ensure that the ground level concentrations from the combined emissions of SO_2 from Kwinana industries did not exceed the EPP criteria, the EPA allocated emission limits to industries, which restricted the emissions to be less than the potential maximum. These emission limits (maximum permissible quantities) were used in the model to ensure that the resulting ground level concentrations were below the EPP criteria. As part of the 1992 determination HIsmelt was allocated a maximum permissible quantity of 35g/sec (EPA, 1992).

The issues, including health aspects, relating to emissions of SO_2 are addressed in Section 7.3.3.1 of the PER. The Proponent engaged a consultant to undertake an air modelling study to determine the potential ground level concentrations resulting from the emissions of SO_2 from the Plants (Sinclair Knight Mertz, 2002). The results of the study are summarised in Sections 7.3.3.3 to Sections 7.3.3.11 of the PER. The complete Air Quality Assessment Report is reproduced as Appendix C of the PER.

The predicted emissions, resulting ground level concentrations in the EPP Area C (Residential) and the relevant criteria are presented in Table 4.1. Modelling has shown that the predicted concentrations of SO_2 from the Stage 1 Plant, and from both the Stage 1 and 2 Plants operating will be relatively low. The predicted maximum 1-hour resulting ground level concentrations of SO_2 will be 2.6% of the Kwinana EPP Area C (Residential) criteria for the Stage 1 Plant, and 4.9% of the EPP Area C (Residential) criteria for the Stage 1 and 2 Plants operating together. Predicted maximum 24-hour ground level concentrations of SO_2 will be 2.2% of the EPP Area C (Residential) standard for Stage 1, and 4.5% of the EPP Area C (Residential) standard for Stages 1 and 2. Annual average ground level concentrations will be around 0.4% and 0.7% of the annual EPP Area C (Residential) standard for Stage 1 and Stages 1 and 2, respectively.

Comparison with the modelled concentrations for the HRDF's maximum permissible emission rate of 35g/sec, allocated to HIsmelt in the 1992 determination, indicates that concentrations from the Stage 1 Plant will be around half of those predicted for the HRDF. Maximum emissions from both the Stage 1 and 2 Plants operating would be approximately the same as for the 1992 determination, therefore, no increase in the maximum permissible rate allocated in 1992 would be required for the operation of the Commercial HIsmelt Plant.

4.6 PARTICULATES

At the time of preparing the EPP the National Health and Medical Research Council (NHMRC) recommended an annual mean of 90 $\mu g/m^3$ for TSP. There was no Australian air quality guideline for the PM_{10} fraction (particles with a diameter less than 10μm) at that time. The NEPC has set a maximum concentration of 50$\mu g/m^3$ of PM_{10} for a 24 hour period (with the maximum allowable exceedances of 5 days per year).

The Proponent engaged a consultant to undertake an air modelling study to determine the potential ground level concentrations resulting from the emissions of particulates from the Plants (Sinclair Knight Mertz, 2002). The results of the study are summarised in Section 7.3.4.2 of the PER. The complete Air Quality Assessment Report is reproduced as Appendix C of the PER.

Particulate emissions from the Plant stacks, including the health aspects of TSP and PM_{10}, are addressed in Section 7.3.4.1 of the PER. The predicted emissions, the resulting ground level concentrations in the EPP Area C (Residential) and the relevant criteria are presented in Table 4.1. Modelling has shown that the maximum ground level concentrations of the particulates emitted are predicted to occur on-site and then rapidly decrease with distance. For TSP the maximum ground level concentrations are predicted to be 2.5% of the 15 minute limit for the EPP Area C (Residential), and 2.3% of the of the 24 hour standard for the EPP Area C (Residential). The resulting ground level concentrations of PM_{10} are predicted to be less than 6% of the NEPM standard at the nearest residence.

4.7 OXIDES OF NITROGEN

The NEPM standard for NO_2 is a 1-hour average of 0.12ppm (with a 10 year goal of a maximum of one day exceedance per year) and an annual average of 0.03ppm.

Section 7.3.5 of the PER discusses the issues relating to NO_X, including the health aspects, and the predicted NO_X emissions from the Plant. The predicted maximum concentrations of NO_2 at residential areas with the Stage 1 and 2 Plants operating together is 75 $\mu g/m^3$, which is equivalent to 30% of the NEPM standard.

4.8 OZONE

The NEPM standards for photochemical oxidants (as ozone) are 0.10ppm for 1 hour and 0.08ppm for 4 hours, with a goal of the maximum number of exceedances of one day per year. The potential health impacts associated with the exposure to ozone are discussed in Section 7.3.6.1 of the PER. The impact of the Project on ozone levels is discussed in Section 7.3.6.3 and in Appendix C (Sinclair Knight Mertz, 2002) of the PER.

Photochemical modelling, using the current modelling mix, indicates that the:

- current impact from the Kwinana industrial emissions on Perth ozone levels is small (4% to 6% contribution);
- emissions from the Stages 1 and 2 Plants will be a small component (up to 9.6%) of the 1998/1999 Kwinana industry emissions; and
- overall emissions from the Kwinana industries are estimated to only increase a small amount from 1998/1999 inventory due to the replacement of the Kwinana Power Station Stage B with a gas-fired plant (Sinclair Knight Mertz, 2002).

Monitoring has shown that Perth's ozone levels have been below the NEPM criteria since 1997. It is considered that the addition of the Stage 1 and Stage 2 HIsmelt Plants will have negligible impact on Perth's ozone levels.

4.9 CARBON MONOXIDE

The NEPM standard for carbon monoxide (CO) is 9.0ppm for 8 hours. The predicted maximum 8 hour concentrations of CO from the Plant are shown in Table 7.10 of the PER (pg 7-26). The concentrations at the nearest residential area are predicted to be less than 0.16% of the NEPM standard.

4.10 DIOXINS AND FURANS

The potential for emissions of Dioxins and Furans from the Plant is discussed in Section 7.3.8 and Appendix G of the PER. Some of that information has been abstracted from the PER and presented below together with additional information to support the Proponent's findings.

4.10.1 Issue

Dioxins are man made chemical compounds that enter the air through fuel and waste emissions. Most human exposure to Dioxins occurs through the consumption of contaminated foods. Dioxins may also be carried in rain and contaminate soils and watersheds. Skin rashes, liver damage, weight loss, and a reduction in the effectiveness of the immune system have all been attributed to human exposure to Dioxins. There is limited health information on Furans, although there is some discussion that both Dioxins and Furans may promote cancer.

Integrated iron and steel plants have been identified as a major source of Dioxin and Furan emissions. Figures from the European Union estimate that in 1995 the Iron and Steel Industry was responsible for 19% of total European emissions of Dioxins and Furans (European Commission, 2000). This has largely been due to emissions from sinter plants, which are used to recycle waste oxide materials arising from operations at the integrated works. Oily mill scale from the casting and rolling of steel is a source of chlorine that reacts with carbonaceous particles and oxygen in the exhaust gas stream to produce the Dioxins and Furans.

The offgas handling system for the Plant was selected to ensure that no Dioxins and Furans would be emitted to the atmosphere. A discussion on the rationale to the selection of the offgas handling systems in relation to Dioxins and Furans is provided below

4.10.2 Generation Mechanisms

The term Dioxin is used to denote the family of compounds known chemically as polychlorinated dibenzo-dioxins (PCDD). The term Furan refers to the family of compounds known chemically as polychlorinated dibenzo-furans (PCDF). Collectively there are 210 compounds within these two families, which have a wide variety of environmental, chemical and physical properties. Compounds with chlorine present at the 2,3,7,8 positions within the molecules have the greatest potential toxicity. Levels of Dioxins and Furans are typically reported in terms of a toxic equivalent (I-TEQ) to 2,3,7,8 dibenzo-dioxin using an agreed international scale of toxicity for each congener.

Dioxins and Furans originate from high temperature processes such as from solid waste incineration, sinter plants and electric arc furnaces. The two main mechanisms believed to describe the formation of PCDD/PCDF during combustion processes are:

- De-novo synthesis; and
- Precursor route.

The two mechanisms are not mutually exclusive, and a combination of the two may occur.

<u>De-novo Synthesis</u>

De-novo synthesis is considered one of the major mechanisms for PCDD/F formation in industrial high temperature processes. Under this mechanism PCDD/Fs are formed by the reaction of gaseous chlorine and unburned aromatic compounds in dust particles in the offgas stream. The reaction is believed to involve metal species that act as catalysts, forming metal chlorides on the surface of the dust particles that react with the aromatic compounds. Chlorinated aromatics, including PCDD/Fs, are then formed through oxidation. It has been demonstrated that the PCDD/Fs are actually formed when the flue gas is cooled, the optimum temperature window being in the 250 – 450 °C range.

<u>Precursor Route</u>

Under the Precursor mechanism chemically related chlorinated aromatics react on the surface of dust particles in the presence of metal catalysts. Two precursor molecules combine to form a Dioxin or Furan molecule. These reactions have been demonstrated to occur when the flue gas has cooled to the 250 – 450°C range.

For either of the above mechanisms to occur the following must be available:

- Solid particles containing carbon structures.
- Organic or inorganic chlorine.
- Copper or iron ions (zinc or manganese are also indicated).
- An oxidising atmosphere.
- A temperature window of 250 – 450 °C.

4.10.3 Dioxins and Furans in the HIsmelt Process

At the HRDF a number of the above conditions for PCDD/F formation existed including:

- carbonaceous dust particles;
- chlorine;
- metal species; and
- the gas was cooled to 200 °C prior to being cleaned by a fabric bag filter.

However, under normal operation an oxidising atmosphere was not present.

Sampling of the offgas stream for PCDD/Fs was undertaken on three occasions during the operation of the HRDF. The offgas was sampled from a point just after the bag filter. Some congeners were detected at levels of 0.09 ng/Nm^3 I-TEQ (note that emission limits in Europe for new waste incinerators are set at 0.1ng/Nm^3 I-TEQ). The gas was then combusted without carbonaceous particles being present, prior to release to atmosphere, therefore it is unlikely that any PCDD/Fs would be present in the gas being emitted to the atmosphere.

4.10.3.1 Commercial Plant Flowsheet Selection

The recognition that conditions for either De-novo or Precursor synthesis of PCDD/F's could occur in the HIsmelt Plant was one of the factors that led to the decision to include a high temperature gas cleaning step in the Process flowsheet. Reacted hot gases (approximately 1450 °C) will exit the vessel and be cooled in a radiation cooler (the Offgas Hood) raising steam. The offgas, at approximately 1000 °C, will then be split, approximately half will be used to pre-heat and partially pre-reduce iron ore feed, the remainder of the offgas will be cleaned in a wet venturi scrubber. Particulates and soluble species, including chlorides, will be directed to the liquid phase for removal. The cleaned offgas will then be available for use as a fuel in the hot blast stoves or a waste heat recovery system for power generation.

It is believed that emission of Dioxins and Furans will not occur in the process due to the following reasons:

- Wet scrubbing at a high temperature (1000°C) will remove chlorine from the gas, thus eliminating one of the species necessary for De- novo synthesis as the gas cools.
- Wet scrubbing at a high temperature prevents the condensation of metals on the surface of carbonaceous dust particles.
- Free oxygen is not present in the offgas stream as the gas has considerable reducing potential.
- After scrubbing the gas is combusted converting all organic species to CO_2.

In order to confirm that the Process flowsheet proposed for the Plant has a low potential for the generation and emission of Dioxins and Furans, the Proponent commissioned Sinclair Knight Mertz to undertake a review of the HIsmelt process flowsheet. The study concluded that the potential for the emission of Dioxins and Furans from the Plant would be low and similar to that expected from a natural gas burning utility boiler. A copy of the report is included as Attachment A.

4.10.4 Monitoring

Sampling of the offgas will be undertaken during the first year of the Stage 1 Plant operation to establish if there are any Dioxins or Furans present. Monitoring results will be provided to the DEWCP. Future monitoring will depend upon the results of the initial monitoring. In the unlikely event that Dioxins and Furans are being generated by the Process and emitted to the atmosphere the Proponent will investigate the source of the emissions and will continue regular monitoring.

If monitoring confirms that no Dioxins and Furans are being generated by the Process and emitted then sampling and analysis of the offgas for Dioxins and Furans would be undertaken less frequently, upon review of the results with the DEWCP.

It should be noted that if Dioxins and Furans are emitted by the HIsmelt Process at levels above the most stringent standards ($0.1 ng/Nm^3$ I-TEQ) then the Process would not meet global requirements as a replacement for current integrated iron making technology. Should any Dioxins and Furans be detected the Proponent commits to investigating the cause of the generation and emission of the Dioxins and Furans and implementing preventative measures. If it proves impossible to prevent emissions of Dioxins and Furans by modifications to the process or equipment then the Plant would then be closed.

4.10.5 Commitments

The Proponent has made the following commitments in relation to Dioxins and Furans.

During the first year of operation, the Proponent will sample and analyse the offgas emissions to establish if there are any Dioxins or Furans present

Monitoring results for Dioxins and Furans will be provided by the Proponent to the DEWCP.

Future monitoring of the offgas emissions for Dioxins and Furans will be reviewed by the Proponent in conjunction with the DEWCP once the results of the first years monitoring have been assessed.

4.11 VOLATILE ORGANIC COMPOUNDS AND POLYAROMATIC HYDROCARBONS AND PERSISTENT ORGANIC POLLUTANTS

4.11.1 Issue

The use of coal as the reductant and energy source has the potential to result in emissions of Volatile Organic Compounds (VOCs), Polyaromatic Hydrocarbons (PAHs) and Persistent Organic Pollutants (POPs) (which include Dioxins and Furans as discussed above). PAHs and VOCs are thought to be possible carcinogens.

The manner in which the HIsmelt Process utilises coal, as discussed above, will result in a very low potential for the generation of the above listed compounds. The combustion of the offgas will destroy any VOC's, PAH's etc that have managed to survive the high temperatures in the SRV resulting in no significant emissions of these species to the atmosphere.

4.11.2 Sampling of the HRDF Offgas

The offgas from the HRDF was sampled and analysed for VOCs on a number of occasions, and specifically for PAHs on one occasion. The gas was sampled after being cleaned in a bag filter and prior to combustion. The results indicated that levels of VOCs were in the very low parts per billion range and PAHs in the gas totalled $4.4\mu g/Nm^3$. These compounds were then subjected to high temperature combustion prior to release to the atmosphere. This combustion stage would have resulted in the destruction of these compounds in the offgas ensuring there were no emissions to atmosphere.

4.11.3 Monitoring

Sampling of the offgas will be undertaken during the first year of the Stage 1 Plant's operation to establish if there are any VOCs, PAHs or other POPs present. Monitoring results will be provided to the DEWCP. Future monitoring will depend upon the results of the initial monitoring. In the improbable event that those species are being generated by the Process and emitted to the atmosphere the Proponent will investigate the source of the emissions and will continue regular monitoring.

4.11.4 Commitments

The Proponent has made the following commitments in relation to VOCs, PAHs and POPs

During the first year of operation, the Proponent will sample and analyse the offgas emissions to establish if there are any VOC's, PAH's or POP's present.

Monitoring results for VOC's, PAH's or POP's will be provided by the Proponent to the DEWCP.

Future monitoring of the offgas emissions for VOC's, PAH's or POP's will be reviewed by the Proponent in conjunction with the DEWCP once the results of the first year's monitoring have been assessed.

4.12 HEAVY METALS

The issues, management and monitoring of heavy metals from the Plant are discussed in Section 7.3.9 of the PER.

4.12.1 Issue

Iron ore, coal and fluxes contain trace quantities of metallic elements such as zinc, lead and cadmium. These elements may be released during processing as discussed below.

Zinc is one of the most common elements in the earth's crust. It is found in air, soil and water and is present in all foods and is an essential element in our diet. Too little zinc can cause health problems, but too much zinc may be harmful to health. Harmful effects are generally observed when the intake is around 100 to 250mg/day which is 10 –15 times the recommended dietary allowance. The effects of the short term ingestion of too much zinc can be stomach cramps, nausea and vomiting. If taken longer, it can cause anaemia, pancreas damage, and lower levels of lipoprotein cholesterol (the good form of cholesterol). Breathing large amounts of zinc as dust or fumes can cause 'metal fume fever', which is believed to be an immune response affecting the lungs and body temperature (ATSDR, 2001a).

Lead is a naturally occurring metal found in all parts of our environment. Lead can affect almost every organ and system in our bodies with the most sensitive being the central nervous system, particularly in children. Lead can also damage kidneys and the reproductive system. At high levels lead may decrease reaction time, cause weakness in fingers, wrist or ankles and possibly affect the memory. Children are more vulnerable to lead exposure than adults (ATSDR, 2001b).

Cadmium is a natural element occurring in the earth's crust. Breathing high levels of cadmium can severely damage the lungs and can cause death. Eating food or drinking water with very high levels of cadmium can severely irritate the stomach, and lead to vomiting and diarrhoea. Long term exposure to lower levels of cadmium in air, food or water leads to a build up of cadmium in the kidneys and possible kidney disease. Other long term effects are lung damage and fragile bones (ATSDR, 2001c).

4.12.2 Potential for Heavy Metals in the Process

Experience from the HRDF, and information from other iron and steel making processes, indicates that metallic elements such as zinc, lead and cadmium will report predominantly to the SRV offgas stream as metallic vapour.

An investigation of the thermodynamics of these species indicates that they will remain in the gas as vapours at temperatures above 800°C. Half of the total present will pass into the Pre-heater, where they will condense on the hot ore particles and be recycled to the SRV, with the remainder being passed into the wet scrubber. Wet scrubbing, at a temperature between 900°C and 1000°C, prevents these species from condensing on the surface of dust particles. The low pH liquid phase in the quench zone of the wet scrubber will result in the dissolution of these elements. Should any metals pass through the wet scrubber they will be subjected to further scrubbing with water in the offgas cooler.

Combustion of the gas in the WHR will be followed by another scrubbing stage in the Flue Gas Desulphurisation (FGD) system. It is therefore considered unlikely that there will be any emissions of heavy metals to the atmosphere.

The metallic elements will remain in solution through the scrubber circuit and report in the slurry to the clarifier. In the clarifier the addition of caustic for pH control and the reaction of metallic elements with dissolved hydrogen sulphide will result in a high proportion of the metallic elements being precipitated. These will be recycled to the SRV with the clarifier sludge. Any of these metals remaining in solution will be directed to the process water tank in the scrubber circuit blowdown. The addition of lime to raise the pH to 8 will precipitate the remaining metals as hydroxides.

The offgas system for the Commercial HIsmelt Plant has been designed to have the offgas cooled at 1000°C. At this temperature the metals are present in the offgas stream as vapours. It must, however, be noted that the raw materials contain only trace levels of heavy metals so the mass flow of heavy metals in the offgas stream is low.

Removal of the metals from the gas stream will be by either of the following mechanisms :-

- Contact with the quench spray water in the top of the scrubber will rapidly oxidise the metals allowing them to dissolve in the water (which is slightly acidic due to the scrubbing of compounds such as hydrogen chloride and some sulphur dioxide from the gas);
- Metal vapour that is not contacted by the water sprays will condense on the surface of dust particles and will be removed in the venturi section of the scrubber.

The metals that dissolve in the scrubber water will then react with the hydrogen sulphide, which has also dissolved out of the gas phase, and be precipitated. The sulphides will then be removed from the scrubber water circuit in the clarifier, and report to the sludge.

Should any heavy metals pass through the primary wet scrubber they would then pass into a packed tower where the gas stream will be further cooled by water sprays. Although not designed to be a particulate scrubber it is believed that some particulate material (and any heavy metals that may have condensed on the surface) will be removed at this stage.

The offgas will then be used as a fuel in the stoves and Waste Heat Recovery system. The exhaust gas from these combustion processes will be directed to the FGD where sulphur dioxide will be removed. Some of the residual particulate material will be removed and any residual heavy metals will be dissolved in the FGD.

A mass balance for heavy metals in the Process is shown in Table 4.3.

Table 4.3

Mass Balance for Heavy Metals

Material	Zn (ppm)	Pb (ppm)	Cd (ppm)	Zn (kg/hr)	Pb (kg/hr)*	Cd (kg/hr)*
Coal	10	<5	<1	0.7	0.07	
Iron Ore	50	<5	<1	8.5	0.17	
Fluxes	30	<5	<1	0.5	0.02	

* based on an assumed 1ppm Pb no data for Cd in raw materials is currently available to the Proponent.

The PER (Section 7.3.9) provides estimates of the quantities of heavy metals in the Process. The flowsheet for the Process estimates that 19kg/hr of Zn, 1kg/hr of Pb and a few g/hr of Cd may be present in the gas leaving the Smelt Reduction Vessel. These estimates reflect that:

- approximately half of the offgas flow is passed through the Preheater, any heavy metals in that gas stream will condense on the ore particles and be recycled to the SRV; and
- the scrubber sludge is recycled back to the Process.

This will result in a recirculating load of heavy metals within the Process at levels higher than indicated in Table 4.3, as reported in the PER. A portion of the sludge will be removed from the process to maintain these levels at a manageable level.

The removal efficiencies of the various scrubbing stages are not known with a high degree of certainty. However, the combination of the three stages will result in a high removal efficiency. For instance if a conservative estimate of 75% removal efficiency at each stage is assumed, an overall efficiency of 98.4% will be achieved. It is, however, believed that the first stage of wet scrubbing will achieve at least 90%, which, if the efficiency for each of the other two stages is 75%, will result in an overall efficiency of 99.4%, so an almost complete removal is expected. When applied to the proportion of the gas not passing into the Preheater the estimated emissions of Zn, Pb and Cd under the two scrubbing efficiency scenarios, 98.4% (and the anticipated 99.4%), is 330μg/Nm^3 (124μg/Nm^3) for Zn, 15μg/Nm^3 (6μg/Nm^3) for Pb and <1μg/Nm^3 for Cd. These are well below the US EPA emission standards for Large Waste Combustors.

4.12.3 Monitoring

Sampling of the offgas will be undertaken during the first year of the Stage 1 Plant operation to establish if there are any significant concentrations of heavy metals being emitted to the atmosphere. The results will be provided to the DEWCP. Future monitoring will depend upon the results of the initial monitoring. In the unlikely event that significant concentrations of heavy metals are being emitted then the Proponent will investigate the source of the emissions and will continue regular monitoring.

If monitoring confirms that there are no significant concentrations of heavy metals being emitted then sampling and analyses of the offgas for heavy metals would be undertaken less frequently, upon review of the results with the DEWCP.

4.12.4 Commitments

During the first year of operation, the Proponent will sample and analyse the offgas to establish if there are any significant concentrations of heavy metals present.

Monitoring results for the heavy metals will be provided to the DEWCP.

Future monitoring of the offgas emissions for heavy metals will be reviewed by the Proponent in conjunction with the DEWCP once the results of the first year's monitoring have been assessed.

4.13 ODOUR

The issue and management relating to potential odours from the Plant are addressed in Section 7.3.10 of the PER. The main potential for odour is from the generation of hydrogen sulphide during the cooling of the slag. Experience at the HRDF showed that any odour of hydrogen sulphide that occurred was localised in the vicinity of the slag pits. The Core Plant building for the Commercial HIsmelt Plant will be located adjacent to the slag pits, therefore, any hydrogen sulphide emissions will be a health issue for site personnel and will be managed on site.

5. OTHER HEALTH ISSUES

5.1 GENERAL

The Proponent has addressed all of the environmental issues and management in the PER. This section provides a discussion on the health aspects of the issues addressed in the PER, other than atmospheric emissions.

5.2 HEALTH AND SUSTAINABILITY

Health assessment aims to facilitate the reduction or avoidance of negative impacts on human health and enhancement of the positive impacts, and in so doing promote sustainable development, with human health being central to the core of the concept of sustainable development (enHealth, 2001).

Section 2.4 of the PER addresses the issue of sustainability. The Project will result in the following positive impact on the health of society, communities and individuals:

- Longevity increase in mining operations improves stability of communities in the Pilbara and intergenerational equity. Apart from the economic impact on individuals of continuing employment the mental impacts both at individual and communities level of sustainability is positive.
- Reduction of greenhouse gas emissions (CO_2 per unit of product), as shown in Table 7.11 of the PER, on a global basis by the worldwide implementation of the technology has an indirect impact on people's health due to fears and concerns associated with global warming and its consequences.
- The health impacts associated with emissions (such as Dioxin, Furans, PAH's, VOC's and heavy metals) from sinter plants and coke ovens in the traditional integrated iron and steel industry will be eliminated.
  These known health impacts will not be relevant for the HIsmelt Plant but relevant to the global industry, particularly in the more undeveloped world where lower standards are known to exist and will only be reduced by the use of new technology.
- Sustainability to the community will be enhanced locally due to direct and indirect employment, which result in positive health impacts for an expanding vibrant community in contrast to one that is contracting or has significant unemployment.

5.3 BENEFITS OF THE PROJECT

The Project will provide significant direct and indirect benefits to the nation, state and local community as discussed in Sections 2.1, 2.2 and 2.3 of the PER. These Project benefits will result in positive health impacts from:

- Generation of new employment opportunities (800 jobs in Western Australia from the Stage 1 Plant).
- Recognition of 'Kwinana' as the site for a world first HIsmelt recognising Australian developed technology.
- Economic benefits at local, state and national levels.

5.4 SOCIO ECONOMIC

Socio- economic impacts of the Project are discussed in Section 8.2 of the PER. The Project will have regional and local benefits on the social environment by providing direct and indirect employment opportunities and other economic advantages brought to the state and region by establishing a HIsmelt Plant in Kwinana, Western Australia. Employment is a major determinant of physical and mental health and well being for the employees and their families. This in turn will have positive impacts on the health aspects of the community.

5.5 EMPLOYEE HEALTH BENEFITS

All HIsmelt employees (in common with Rio Tinto policy that applies to all group sites) have direct health benefits including:

- Pre-employment and ongoing health evaluation;
- Comprehensive occupational health and safety training.
- Provision of all appropriate personal protective equipment.
- Subsidised private health care for employee and family.
- Employee assistance programme that provide confidential access to services such as psychological help for stress (from whatever cause), hypnosis to stop smoking and general counselling.
- Speak out programme that is confidential access to a third party as a whistle blower.
- Drug and alcohol programme that provides for random testing and when applicable counselling and rehabilitation support.

Many of the above programmes are also applicable to contractors working with HIsmelt employees.

5.6 TRANSPORT

Issues relating to the road, rail and ship movements of raw materials and product related to the Project are discussed in Sections 7.16.1, 7.16.2, and 7.16.3 of the PER, respectively. The iron ore, coal and dolomite will be transported to site by either rail or ship, which are recognised as safer transport modes than by road.

The Project will result in only a small percentage increase to the existing rail movements between Koolyanobbing and Kwinana. The increase in existing ship movements in Cockburn Sound due to the Project may be up to 8%.

The Plant will be operated on two 12-hour shifts per day with around 16 people working on each shift. Assuming every person drives to the site then there would be an additional 64 employee vehicle movements per day. The Stage 2 Plant would require around the same number of employees therefore there would be an additional 64 movements for Stage 2. Other vehicles will also visit the site for various business reasons.

There will be an estimated 73 truck movements per day for the Stage 1 Plant, which is conservatively doubled to 146 when Stage 2 becomes operational.

The number of vehicle movements along the main roads that service the site are presented in Table 5.14 of the PER.

The counts on Rockingham Road at the rail bridge south of Beard Street are around 38,000. The heavy vehicle component for Rockingham Road (south of Russell Road) is 12% (Main Roads, 2002), which can be calculated at around 4560 trucks per day. The Project will increase the heavy vehicles on Rockingham Road by around 1.6% for Stage 1, and up to 3.2% with Stage 2 operating.

Counts at Leath Road in 1995 showed that the Annual Average Daily Traffic (AADT) on the road was 1657. Beard Street recorded an AADT of 2247 in 2000 with a heavy vehicle component of around 25% (Kwinana Town Council, *pers. comm.* 2002). Assuming that Leath Road also has a 25% heavy vehicle component, then there were 414 trucks per day using Leath Road and 561 trucks per day using Beard Street in 2000.

Based on the currently available data the increase on Leath Road would be 8.3% in total vehicle movements and a 17.6% increase in truck movements for Stage 1. The increase in total vehicle movements for both the Stage 1 and Stage 2 Plants operating would be 16.5% with an increase of 35.2% in heavy vehicles on Leath Road. The increase in total vehicle movements on Beard Street would be 6.1% with an increase of 13% in heavy vehicle movements for Stage 1. At this stage the estimated increase in total vehicle movements for Stage 1 and Stage 2 operating would be 12.2% with a 26% increase in heavy vehicles on Beard Street. It is planned to commission Stage 1 in 2004 with the potential Stage 2 Plant being commissioned in 2007. Therefore the actual percentage increase in traffic and heavy vehicles is likely to be lower than currently estimated due to increased traffic at the time of commissioning the Plants.

The increase in road traffic due to the Project is not expected to have a significant impact on the main roads servicing the site. The Rockingham Road/Beard Street intersection is where all trucks will enter into Beard Street. Main Roads WA has advised that the additional truck movements due to the Project will not have a significant impact on the operation of this intersection.

5.7 FUGITIVE DUST

The issues, criteria, management and monitoring of dust are presented in Section 7.5 of the PER. The Proponent has assessed the impacts of dust from the on site operations (Section 7.5.3), the rail transport of the ore (Section 7.5.4) and the ship unloading of iron ore and coal (Section 7.5.5).

The Proponent will monitor dust concentrations at the site to ensure that they are within the EPP criteria for TSP. The EPP criteria have been developed based on protecting the environment (including human health) as discussed in Section 5.1 of this report.

5.8 NOISE

As stated in the PER (Section 7.6.1) and the Environmental Protection (Noise) Regulations 1997, noise can seriously disrupt people's lives, causing loss of sleep, interference to activities and emotional stress. The Noise Regulations assign levels for noise sensitive premises, which includes residential premises. It is these levels to which the worst case noise modeling results for the HIsmelt Project have been compared. The issues (Section 7.6.1), criteria (Section 7.6.2), modelling (7.6.3 and 7.6.4), management (Section 7.6.5) and monitoring (Section 7.6.6) of noise from the Plant is addressed in the PER. Noise from the shipping operations, and road and rail movements are discussed in Section 7.6.7 and 7.6.8 of the PER, respectively.

The Proponent engaged a consultant to undertake an acoustical modelling study on the predicted noise emissions associated with the operations of the Plant at Kwinana (Herring Storer Acoustics, 2002a). The complete report is provided as Appendix H of the PER. Modelling showed that the predicted noise levels from the Stage 1 Plant will be at least 5dB(A) below the assigned noise levels at the surrounding residences. The predicted noise levels from the Stage 1 and 2 Plants operating will also be at least 5dB(A) below the assigned noise levels. Therefore, the noise levels at the residential areas from the Stage 1 Plant and the Stages 1 and 2 Plants will comply at all times with the Environmental Protection (Noise) Regulations, 1997.

A noise monitoring survey will be undertaken to ensure that noise levels are as predicted in the PER.

Fremantle Ports undertook modelling to predict the noise emissions associated with the shipping operations related to the HIsmelt Project (Herring Storer Acoustics, 2002). The modelling results show that noise emissions are predicted to comply with the Environmental Protection (Noise) Regulations, 1997.

Noise from the trucks transporting materials for the Project along Rockingham Road are predicted to have no significant increase in the existing noise levels at residences.

Calculations indicate that the noise level increase in L_{Aeq} for train movements would be in the order of 0.1dB(A) to the existing conditions for the Stage 1 Plant and an additional 0.1dB(A) between the Stage 1 and Stage 2 Plants. Although this is a total increase of 0.2dB(A), this is not considered significant as the calculations were conservative due to noise levels for maximum power and speed being applied, and the existing noise levels at the time of commissioning of Stage 2 will be higher than current levels (Herring Storer Acoustics, 2002a).

5.9 VIBRATION

The potential impacts of vibration at the Plant and from rail operations are discussed in Section 7.7 of the PER. Significant vibration levels are not expected to result from the operation of the Plant. The vibration from the proposed trains is likely to be similar to those already emitted by the existing trains.

5.10 SURFACE WATER RUNOFF AND WASHWATERS

The site is located within the Environmental Protection (Cockburn Sound) Policy Area. The issues, management and monitoring of surface water runoff and washwaters are presented in Section 7.8 of the PER.

Surface water runoff and washwaters will be managed as discussed in the PER to ensure that there is no impact on the environment and, therefore, no impact on health.

5.11 SLAG

Slag will be produced as a by-product of the Process. A typical composition of the slag is listed in Table 4.5 of the PER, which indicates that the slag will meet the inert waste criteria as outlined in the Department of Environmental Protection's Guidelines for Acceptance of Solid Waste to Landfill (DEP, 2001). Issues and management relating to the slag are presented in Section 7.9 of the PER.

Slag produced in the HRDF was subjected to leaching tests in order to determine whether there would be any possibility of groundwater contamination from stockpiles of slag, or from areas in which the slag has been used as a road base or for similar applications. Results of an analysis of the leaching properties of slag produced at the HRDF are shown in Table 7.22 of the PER. The results of the leaching tests show that the levels in the leachate were below the criteria for drinking water.

Further evidence that the slag is not leaching can be seen from the groundwater monitoring results of water from the bore located down gradient of the existing slag stockpile, which show that there has not been an increase in the concentrations of leachable species in the groundwater (see Section 5.7.4 of the PER).

The slag will be managed to ensure that there is no potential for harmful components of the slag to leach and pollute groundwater.

5.12 HAZARDOUS MATERIALS

Hazardous materials issues and management are discussed in Section 7.10 of the PER. Hazardous materials management will ensure that the storage, use or disposal of hazardous materials does not have an adverse effect on the health and safety of employees, contractors or the general public.

5.13 WASTE MANAGEMENT

Wastes from the site have been divided into the following three categories in the PER:

- Solid Waste (PER Section 7.11.1);
- Process Wastewaters (PER Section 7.11.2); and
- Sewage (PER Section 7.11.3)

Solid Wastes

Solid waste streams generated during the operation of the Plant will be mainly from gas cleaning, refractory replacements, and general solid waste. The main types of solid wastes that will require disposal will be:

- Scrubber Sludge;
- Refractory Materials; and
- General Waste.

An estimated composition of the scrubber sludge is presented in Table 7.23 of the PER. The actual composition will be determined once the Plant is in operation. From the estimates the concentration of some species may result in the material failing to meet the inert waste criteria on composition alone. Leaching tests will be undertaken on the sludge to determine the class of landfill that could accept this material if re-use on-site or at a neighbouring facility proves not to be feasible. It should be noted that the proposed offsite use of this material would lock up any species of concern in a product, from which leaching would not be an issue.

There will be two types of refractory material; magnesia-chromite and alumina, as discussed in the PER. It is currently planned that the worn magnesia–chromite refractory lining will be sent to an approved landfill as the chromium content generally precludes it use as an aggregate in construction applications. The class of landfill will be determined at the time of disposal through consideration of the material chemical analysis and the results of leaching tests. Methods of recycling of this material will continue to be explored in order to reduce the quantity of solid waste from the site going to landfill.

The alumina refractories contain no potentially harmful constituents. When these materials are replaced it is expected that they will either be recycled for use on-site or directed to a waste management facility for processing into an aggregate material.

Process Wastewaters

The main wastewater generated by the Plant will be scrubber blowdown from the clarifier circuit, which has the potential to contain high concentrations of TDS and some heavy metals. The blowdown from the Plant will be directed to the process water tank from where it will be used for the cooling of the slag and pig iron. A water balance for the Plant presented in the PER shows that during normal operations with the exception of extreme rainfall events, no process effluent will require disposal off site.

In the event that excess water is collected from rainfall runoff, the water will be discharged through the Water Corporation's Point Peron outfall. Prior to disposal into the Point Peron line the water will be sampled and analysed and the results provided to the Water Corporation to ensure that the quality meets the requirements.

Sewage
The two existing septic systems on site will be replaced with Nutrient Retentive Sewerage Systems following approval from the Environmental Health Section of the Town of Kwinana and the WA Health Department. This type of system is similar to common systems in that it involves a below ground tank and leach drains. However, the process that takes place inside the tank reduces the quantity of nitrogen and phosphorus in the effluent stream. The system will not result in any unpleasant or offensive odours.

All of the above waste streams will be managed, as discussed in the PER, to ensure that there is no adverse impact on the environment or human health from their disposal.

5.14 SITE CONTAMINATION

The existing contamination on the site and potential to disturb these areas are discussed in Section 7.12 of the PER. Any identified areas of contamination that have the potential to be disturbed by the Project and /or require remediation will be subject to remediation by the owners of the site, Landcorp. Any remediation work will be undertaken in accordance with the DEP's Guidelines for Contaminated Sites (DEP, 2000).

5.15 VISUAL AMENITY

Visual amenity is addressed in the PER (Section 8.3) with a visual presentation of the Plant super imposed on photographs taken from road vantage points (Figure 8.1 of the PER). The photographs indicate that the Plant is unlikely to impact on the existing visual amenity of the area.

5.16 HAZARDS

Any chemical or pyro-metallurgical process, such as the HIsmelt Process, may have a number of potential hazards including:

- raw material and intermediate toxicity and reactivity;
- energy releases from chemical reactions; and
- high temperatures and pressures.

The Proponent has identified the following generic hazards that apply to the Plants on site:

- Loss of containment - Molten iron.
- Loss of containment - Molten slag.
- Explosion caused by mixing hot metal/slag with water.
- Hot, toxic, flammable gases.
- Cooled, toxic, flammable gases.
- Coal Dust.
- Flammable cryogenic gases and liquids.
- Non-flammable cryogenic gases and liquids.

Loss of Containment of Molten Iron and/or Slag

The molten bath inside the SRV will have a temperature of between 1400 and 1500°C. Any breakout can result in injury to personnel, fire, damage to peripheral equipment and toxic gas and fume generation. The fact that the SRV operates at a pressure of 80kpa above atmospheric pressure can result in molten material being sprayed a considerable distance from the vessel walls.

In order to minimise the likelihood of such an event, and the consequences if such an event does occur, a number of safeguards and procedures will be implemented, including:

- Regular monitoring of the structural integrity of the SRV using built in monitoring instrumentation, and regular inspections using an infrared thermal imaging camera.
- The hearth section of the SRV will be lined with refractory bricks for containment of the molten metal bath. The vessel shell above the hearth will be protected from molten slag and high gas temperatures by a series of water-cooled panels attached to the vessel walls. Flow rate and water temperature will be continuously monitored to ensure they are within design criteria.
- Two bottom cooling fans (one operating and one on standby) will be installed between the bottom plate and the SRV sidewall. The cooling air will be ducted to a series of channels formed between the SRV support girders. These channels will be sized to provide adequate air velocity for efficient cooling.
- In the event of a breakout, hot metal and or slag will be captured in a bunded area around the base of the SRV and will flow into an emergency pit that will be installed for such emergency situations.
- Personnel working in the immediate vicinity of the SRV will receive special training with regards to working with hot molten materials and will also wear appropriate protective clothing.
- To prevent over pressurisation of the SRV (which could result in a rapid surge of molten material flowing from the forehearth) a pressure relief valve will be situated at the top of the offgas hood that will vent the pressurised gases at a location that is remote from normally occupied areas. The activation of this valve will cause an immediate emergency shutdown of the Process, thus limiting the quantity of gas vented in such an incident. However, it should be noted that there are control systems in place to prevent the pressure reaching the level required to activate the valve. Pressure sensors within the system will cause the Plant to be shut down at a pressure that is lower than the pressure relief valve actuation set point.

Explosion Caused by Mixing Hot Metal/Slag with Water

When a large volume of molten metal or slag comes into contact with a quantity of water the sudden vaporisation of the water to steam will result in an explosion of molten or hot solidified metal or slag that can cause injury or equipment damage. The hot metal and slag pits will be designed so that any water that enters the pits will rapidly drain away to prevent such incidents. Good housekeeping practices will be employed to ensure that pools of water do not accumulate or remain in any areas where hot metal or slag may be present.

Toxic and Flammable Gas

The offgas from the SRV contains flammable components such as CO, H_2 and also toxic components such as H_2S (CO can also be toxic). Any loss of containment prior to the wet scrubber (such as through the pressure relief valve) may result in a jet flame (if a large release) or a toxic plume in the immediate vicinity if a small leak. A release that causes a jet flame may cause fires in nearby equipment modules. Any loss of containment of the cooled Process gas after the wet scrubber will result in a toxic plume of varying extent depending on the size of the leak. The most likely source of such releases will be flanges where segments of the offgas train are joined. During hot commissioning these flanges will be tested for leaks and also subjected to 'hot bolting', where the bolts are tightened at various times as the system heats up to allow for expansion effects.

Pressure sensors located throughout the offgas train will detect major leaks and cause an emergency stop of the process, thereby limiting the inventory of gas available for release (no storage of process gas occurs, the total inventory is that contained within the process ducts).

A network of CO monitors strategically located throughout susceptible areas will detect both major and minor leaks. These monitors are calibrated to alarm at 30ppm CO (the TLV/TWA value for occupational exposure). In addition personnel working in susceptible areas will be issued with portable CO monitors (that alarm at 30ppm) for personal protection.

Coal Dust

The coal used in the process is subjected to drying and grinding prior to use. A number of design features will be incorporated to minimise risks and reduce the consequences of fire and/or explosion due to elevated coal dust concentrations in the coal storage and grinding areas of the Plant. The operation of the coal drying and grinding circuit is outlined in Section 4.6.2 of the PER.

An oxygen sensor that only permits operation once the oxygen content in the exhaust gas stream is below 10%V/V controls the introduction of coal to the circuit to prevent explosions. The fine coal storage bin will be normally flushed with nitrogen to ensure that coal combustion does not occur. A number of temperature measuring devices will be located on the silo to provide a warning should excessive temperatures occur, and the bin will be purged with nitrogen if a high temperature is detected. The bin will be vented to a vent filter to ensure that the bin is not subjected to any significant pressures. A silo pressure relief system will also be provided.

Cryogenic Gases and Liquids at the Air Separation Unit

The hazards associated with an Air Separation unit (ASU) are known and understood by the companies which operate them. The ASUs at the site will be installed and operated by Air Liquide WA, a company with extensive experience in the operation of ASUs.

The Compressed Gas Association (based in Arlington, Virginia, USA) has published a Safe Practice Guide for Air Separation Plants that outlines safe operating and maintenance procedures for working with cryogenic gases and liquids (Compressed Gas Association, 1989). Air Liquide apply these procedures in the ASUs that they operate.

5.17 RISK

HIsmelt Plant

The risks and hazards associated with the Project are addressed in Section 9 of the PER. The Proponent commissioned a risk consultant to undertake a qualitative risk assessment and to provide risk management details of the Project (DNV, 2001). The following provides a summary of the study.

The scope of work undertaken for the study was:

- Hazard identification of on-site events that could impose an offsite effect.
- Hazard identification of events from neighbouring facilities, which could impact site personnel and/or facilities and process.
- Qualitative assessment of identified hazards to determine those hazards that will be major risk contributors at HIsmelt's boundary.
- Quantitative review of the major risk contributors to demonstrate likely compliance with EPA criteria.
- Development of risk management plan for the future phases of the Project.

The EPA has published risk criteria for the assessment of the acceptability of a major hazards industry in its Guidance Note for Risk Assessment and Management for Offsite Individual Risk from Hazardous Industrial Plants (EPA, 2000b). The criteria for the assessment of the fatality risk of a new industrial installation are stipulated as:

- A risk level in residential areas of one in a million per year or less, is so small as to be acceptable to the EPA.
- A risk level in "sensitive developments", such as hospitals, schools, child care facilities and aged care housing developments, of one half in a million per year or less is so small as to be acceptable to the EPA.
- Risk levels from industrial facilities should not exceed a target of fifty in a million per year at the site boundary for each individual industry, and the cumulative risk level imposed upon an industry should not exceed a target of one hundred in a million per year.
- A risk level for any non-industrial activity or active open spaces located in buffer areas between industrial facilities and residential areas of ten in a million per year or less, is so small as to be acceptable to the EPA.

The HIsmelt Plant in Kwinana is not classed as a Major Hazard Facility and therefore is not bound by the "Control of Major Hazard Facilities" standard.

The risk assessment methodology used in the study is consistent with AS4360 "Risk Management" and incorporated the:

- identification of potential hazardous events;
- analysis of these hazardous events to determine their credibility; and
- level of harm (consequence).

The study found that the analysis of the consequences for the credible hazardous events determined that the level of harm is limited to the immediate area of the Plant, with the worst scenario being a process gas release with harmful effects for a distance of approximately 50m. The level of harm due to hazardous events such as fires is restricted to the range of the harm due to heat, which is approximately 20m. The distance from the Plant to the nearest site boundary (the north-eastern boundary) is 130m therefore it is concluded that minimal, if any, harmful effects will be incurred at the site boundaries. Therefore the risk level at the site boundary due to these hazardous events (both individual and combined) is determined to be below the EPA criteria for industrial facilities of fifty in a million per year.

The distance from the HIsmelt Plant to the nearest residential area at Hope Valley is approximately 1,500m. A similar analysis to that above determined that the risk level in the nearest residential area will be below the EPA criteria of one in a million per year.

Air Separation Unit

The ASUs will be located on the HIsmelt site. There will be no storage of liquid oxygen on the site and only a minor quantity of liquid nitrogen.

There are health and safety issues associated with the operation of a plant where oxygen rich and oxygen deficient gas streams are present and these will be addressed in the site's Safety Management Plan. The major potential hazard associated with the operation of an ASU is a build up of hydrocarbons in the liquid oxygen stream within the ASU process and a potential for a violent reaction between the hydrocarbons and the oxygen. Excess CO_2 in the air can also build up in the liquid oxygen but is more easily removed from the inlet air than the hydrocarbons.

The same management risk principles that are applied at the Air Liquide Air Separation Plant in Kwinana will be implemented for the ASU on the HIsmelt site. One particular aspect on risk management will be to reduce the potential for the reaction of hydrocarbons and oxygen as mentioned above. The management of this risk will include:

- analysing the intake air and other process streams for hydrocarbons and CO_2; and
- not positioning the air intake directly downwind of the HIsmelt Plant.

Should the hydrocarbon and CO_2 levels at the inlet exceed a critical value the ASU will be shut down until the air quality improves.

Shipping Operations

The risks associated with shipping operations are addressed in Section 9.7 of the PER. Accidents such as ship collisions may cause substantial ecological damage, put workers and the community' health at risk and incur massive clean up costs. The risk of such accidents is minimised by strictly adhering to international and Commonwealth marine guidelines. Fremantle Ports maintains a Marine Safety Plan, which sets out the procedures for ensuring safe operations within the Port of Fremantle.

Transport and Traffic

The risks associated with transport and traffic are discussed in Section 9.8 of the PER. The percentage increase in traffic on the main roads servicing the site, and the railway line due to the Project is relatively small and will be accommodated on the existing networks. Any hazardous materials brought to site by trucks will be transported in accordance with the Dangerous Goods (Transport) (General) Regulations, 1999 and the Dangerous Goods (Road and Rail) Regulations, 1999.

6. COMMUNICATION

HIsmelt has given a high priority to consultation during the planning and environmental assessment phases of the Project. It was recognised that a comprehensive consultation programme is essential to reliably inform the government authorities, other groups and the public of the Project and to obtain input relevant to the development of the Project and the PER. An extensive consultation programme was implemented during the preparation of the PER.

A summary of the consultation programme, those contacted and the key issues raised is provided in Section 6 and Appendix F of the PER. The consultation programme included facilitated community workshops in both Kwinana and Rockingham. Reports from these workshops, which documented all of the issues raised, together with the Proponent's response were sent to the workshop participants. The Reports are reproduced in Appendix F of the PER. The consultation programme has continued since the PER was publicly released with various authorities being consulted and the community to be briefed on the Proponent's responses to the submissions through the Kwinana Communities Industries Forum. The Proponent will conduct follow on activities identified during the consultation through the construction and life of the Project.

7. DISCUSSION AND CONCLUSION

The Proponent has undertaken an environmental impact assessment and has proposed environmental management measures for the HIsmelt Project to ensure that the environment (including human health) is protected. To ensure that all of the issues associated with the Project are managed, resulting in an environmentally sound Project with no adverse health impacts, the Proponent has made management commitments which are presented in the PER (Section 11). The Proponent has summarised the environmental factors, potential impacts and predicted outcome of these factors in the PER (Table ES2).

The Proponent in this Assessment of Human Health Issues has identified the issues associated with the HIsmelt Project, which have the potential to impact on human health, both positively and negatively. These issues, including the health hazards, were addressed in the PER and have also been readdressed in this document.

In its assessment the Proponent has used relevant health based criteria, where available, to determine the potential impacts of the Project.

The major health issues of concern to the community are related to air emissions. The Kwinana region is covered by the EPP, which sets limits for SO_2 and TSP based on protecting the environment (including human health). The criteria for CO, NO_2, ozone, lead and PM_{10} are to meet NEPM ambient air standards, which have also been developed to protect public health.

The Proponent has provided estimates of the atmospheric emissions from the Plant in the PER. The estimated levels of the pollutants, which have the potential to be of concern, were applied to the air modelling study which was undertaken to predict the ground level concentrations resulting from the predicted emissions. These levels were compared with the EPP and NEPM ambient criteria, which both set levels to protect human health.

Emissions of SO_2 and TSP from the Plants are predicted to be below the required EPP criteria. Concentrations of CO, NO_2, ozone and PM_{10} resulting from the Project are predicted to be all below the NEPM criteria. The Proponent predicts that Dioxins or Furans are unlikely to be generated and emitted to the atmosphere by the Plant. There will be negligible emissions of PAHs, VOCs and heavy metals. Therefore there will be no adverse impact on human health due to the emissions from the Project.

The Proponent will undertake monitoring of the emissions from the Plant and will analyse for those pollutants predicted to be emitted, and will also analyse for other emissions that are of concern to the community (Dioxins, Furans, PAHs, VOCs and heavy metals) but are not expected to be emitted at any levels of potential concern.

From the assessment based on the above, the Project will not result in an adverse impact on human health. The Project will have an overall positive health impact on the community due to the significant economic and environmental benefits to the local community, the State, Australia and the world.

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8.2 ABBREVIATIONS AND ACRONYMS

AADT	Annual Average Daily Traffic
ASU	Air Separation Unit
^0C	Degree Celsius
Cd	Cadmium
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Cr	Chromium
DEP	Department of Environmental Protection
DEWCP	Department of Environment, Water and Catchment Protection
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
Fe	Iron
FGD	Flue Gas Desulphurisation
hr	hour
H_2	Hydrogen
H_2S	Hydrogen Sulphide
HAB	Hot Air Blast
HRDF	HIsmelt Research and Development Facility
KBB2	Fremantle Ports Bulk Berth No.2
kg	kilogram
km	kilometres
m	metre
m^3	cubic metre
mg	Milligram
Mg	Magnesium
ML	Mega Litres
mm	millimetres
Mtpa	Mega tonnes per annum
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
Nm^3	Normal cubic metre. One cubic metre of gas at 101.3 kPa pressure and 0 °C (1 atmosphere and 273 °K)
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
pa	per annum
PAH	Poly Aromatic Hydrocarbons
Pb	Lead
PCDD	Polychlorinated dibenzo-dioxin
PCDF	Polychlorinated dibenzo-fluran
PER	Public Environmental Review

$PM_{2.5}$	Particles with a diameter up to 2.5μm
PM_{10}	Particles with a diameter up to 10μm
ppm	parts per million
SO_x	Sulphur Oxides
SO_2	Sulphur Dioxide
SRV	Smelt Reduction Vessel
t	Tonne
TDS	Total Dissolved Solids
TEQ	Toxic Equivalent
thm	tonne of hot metal
TLV	Threshold limiting value
tpa	Tonnes per annum
tph	tonnes per hour
TSP	Total Suspended Particulates
TWA	Time Weighted Average
VOC	Volatile Organic Compound
WHR	Waste Heat Recovery
Zn	Zinc

8.3 GLOSSARY

Blowdown	A purge stream from a water circuit used to control the maximum level of dissolved salts in the system.
Dolime	A mixture of Calcium and Magnesium Oxides formed by subjecting Dolomite (a mixture of Calcium and Magnesium Carbonates) to high temperatures thereby removing Carbon Dioxide (calcine).
Effluent	A liquid waste stream.
Fluxes	Materials added to a furnace to facilitate the removal of gangue constituents (impurities) in the ore and coal through the formation of a mixture (slag) with a suitable melting point, common fluxes include lime and dolime.
Fugitive Dust	Uncontrolled dust emissions arising from activities associated with raw material or construction operations.
Gangue	The mineral impurities in an ore.
Greenhouse Gases	The gaseous constituents of the atmosphere, both natural and man made, that maintain the earth's temperature at a level necessary to sustain life but may contribute to global warming when present at elevated concentrations. These include carbon dioxide, methane and nitrous oxide.
Hot Blast Stoves	Counter current heat exchange system in which a stream of air is heated by passing through a large volume of heated refractory bricks contained in a cylindrical vessel. The refractory bricks are heated by the combustion of process gas.
L_{Aeq}	Noise level average over a certain period of time.
Offgas	The gas stream that flows from the furnace in a smelting process.

Ore Fines	Iron ore with a particle size less than 8mm.
Pig Iron	Solid form of the iron produced by a blast furnace or HIsmelt Process, generally cast into 'Pigs', ingots weighing 5 – 10 kg.
Preheater	Process module designed to dry, pre-heat and pre-reduce iron ore prior to its use in a smelting process.
Post Combustion	The reaction of carbon monoxide and hydrogen, driven off when coal is injected into a molten iron bath, with oxygen in the top space of a smelting furnace.
Reductant	Material capable of reacting with a metalliferous ore to effect the removal of oxygen leaving the metal as a product.
Refractory	A material of very high melting point with properties that makes it suitable for lining components in high temperature applications.
Scrubber	Equipment module for removing particulate or gaseous contaminants from a gas stream.
Slag	Molten material formed by the reaction, at high temperature, of fluxes with the gangue constituents of ores and coal in smelting processes.
Slurry	A semi-liquid mixture of fine solid particles in water.
Smelting	The high temperature process used to produce metal from an ore.
Volatile Matter	Components of a solid material, other than moisture, that are driven off by heating the material.

Attachment A

SINCLAIR KNIGHT MERZ

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4 May, 2002
Document1
WI00353

Hismelt Corportation
PO Box 455
Kwinana,
Western Australia
Australia 6966

Attention: Colin Prickett

Dear Sir:

Evaluation of Dioxin Potential from Proposed HIsmelt Process

You have asked me to evaluate the potential for dioxin and furan emissions from the proposed HIsmelt direct smelting iron production process. I understand that the relevant environmental authorities may be concerned about potential dioxins and that HIsmelt Corporation is seeking an independent opinion on this issue.

You have specifically asked me to review the following information sent on 22 April 2002:
- The flow sheet and process description; and
- HIsmelt' dioxins and furans emissions estimates (designated *Appendix G*).

I have also read the relevant parts of the Public Environmental Review documentation and further process information supplied by HIsmelt in response to my questions. My comments are confined to the potential for dioxins and furans (dioxins) contained in the off-gases from the Smelt Reduction Vessel (SRV).

1. Summary

I believe that dioxin emissions from the process will be minor and probably no different to what would be expected from a natural gas-fired utility boiler. The principal reasons for this view are:
- Dioxin emissions from the iron and steel production industry are primarily associated with sintering plants and electric arc furnaces. Iron making processes (blast furnaces and direct smelting processes alike) contribute to a comparatively small amount of the total emissions from the sector.
- Studies suggest the main mechanism for dioxin formation in iron and steel-making processes is *de novo* synthesis. This mechanism is likely to be minimised in the HIsmelt direct reduction process due principally to the lack of oxygen in the off-gas and rapid cooling.
- Systems are in place to both remove and destroy any dioxins that may form. The proposed two-stage scrubbing process will remove a portion of any dioxins, while combustion in the boiler furnace will destroy dioxins that may escape.

2. Dioxins and Furan Emissions from the Iron and Steel Industry

Various emissions inventories completed throughout the world have identified iron and steel making as a significant source of dioxin emissions. Within this sector, ore sintering is the dominant source. However secondary processing (particularly of dirty scrap) and certain steel making operations (electric arc furnaces) can also contribute. Iron smelting is generally considered a minor source.

The United Nations Environment Program gives emission factors for sintering plants which range from 0.3 to 20 μg/TEQ/tonne sinter, and for secondary melting and steel making of 0.1 to 10 μg/TEQ/tonne metal; compared to iron smelting of 0.01 μg/TEQ/tonne (UNEP Chemicals, 2001)[1]. While the latter figure represents blast furnaces fitted with air pollution control equipment it clearly indicates that iron smelting is not a major source. Similarly, a report prepared for Environment Canada indicates that dioxin emissions from sintering plants account for more than 140 to 200 times the emissions from blast furnace activities in that country (Napier, 2000)[2]. A review of dioxin emissions in the UK has identified sintering, steel making and scrap metals as potential dioxin sources but does not specifically mention iron smelting or reduction processes.

The type of smelting process employed may have some bearing on the dioxin potential but it appears this may not be significant. While there is very little information on direct smelting/reduction processes in general, the measurements undertaken at the HIsmelt Research and Development facility (HRDF) show results up to 0.09 ngTEQ/Nm^3. I am also aware of at least one direct reduction process, where emissions data are available. This is the relatively unusual Lurgi-Stelco process operated by BHP NZ Steel at Glenbrook, New Zealand, where emissions of 0.0186 ngTEQ/Nm^3 [3]have been reported from the direct reduction kilns (MfE 2000)[4]. Again, the Lurgi-Stelco process is very different to the proposed HIsmelt plant but it is interesting that emissions are of a similar order to the above, including the European data for blast furnaces. It suggests that emissions are low across widely varying types of iron smelting processes. Moreover, given the operating conditions expected, it is reasonable to assume that emissions from emerging direct smelting processes, like HIsmelts, will be low. This view appears to be shared by work undertaken on behalf of Environment Canada, who have accepted the industry view that dioxin emissions from direct reduced iron processes are "*expected to be minimal*"[2].

I will discuss the relevant operating conditions in the HIsmelt SRV system below, but will first summarise dioxin formation mechanisms.

3. Dioxin Formation Mechanisms

There are three general mechanisms that can result in emissions of dioxins from combustion systems:

- Incomplete destruction of dioxins present in the fuel source;
- In-furnace formation from "precursor" materials; and

[1] UNEP, January 2001 *Standard Toolkit for Identification and Quantification of Dioxin and Furan Releases* Draft, UNEP Chemicals, Geneva Switzerland, International Environment House 11-13 chemin des Anemones CH-1219 Charelaine, Switzerland.

[2] Napier C E. September 2000 *Background Technical Discussion Paper on the Release and Control of Dioxins/Furans from the Steel Sector.* Prepared for Environment Canada Minerals and Metals Division, Charles E Napier Company Ltd., Ontario Canada.

[3] This corresponds to approximately 0.06 μg/TEQ/tonne

[4] MfE March 2000 *New Zealand inventory of dioxin emissions to air, land and water, and reservoir sources,* Organochlorines Programme, Ministry for the Environment, Wellington New Zealand.

- low temperature downstream formation in the flue gas ductwork (*de novo* synthesis).

In general, formation of dioxins, or poor destruction, are more significant during combustion upsets or when mixing of air and combustible hydrocarbon is poor, since higher levels of organics can escape the furnace at these times. When combustion conditions are optimum, dioxins are generally effectively destroyed. Downstream formation or *de novo* synthesis is usually the more significant mechanism in well operated furnaces, and this is also likely to be the case in the HIsmelt process.

De novo synthesis also appears to be the most significant formation mechanism in the steel industry in general. Most research has been undertaken at sinter plants, where it has been demonstrated that this mechanism is the most predominant (Buekens *et al*, 2001)[5], (Napier, 200)[2]. While there is very little information on formation mechanisms for other iron and steel making processes, the condensation of precursor molecules or *de novo* synthesis are likely to be the principal mechanisms (Napier 2000).

De novo synthesis has been described as the "*oxidative breakdown and transformation of macromolecule carbon structures to aromatic compounds*" (Buekens *et al*, 2001)[5]. It generally occurs in the temperature range of 400 to 250 °C, but some researchers have suggested it can occur up to 1000 °C (Napier 2000)[2]. Studies have shown that oxygen in the gas stream is "*essential*" for dioxin formation by this route. The formation mechanism is also reliant on the presence of degenerate graphitic carbon structures such as coal, charcoal and soot. Copper and other metals can have strong catalytic effects, while rapid cooling and certain additives can inhibit formation.

4. Conditions in the HIsmelt SRV Off Gas

In my view, two key factors will contribute to a low potential for *de novo* synthesis in the off gases from the HIsmelt SRV: lack of oxygen and rapid cooling.

Information supplied to me demonstrates that the SRV off-gas is under strong reducing conditions and the HIsmelt process data indicates that oxygen concentrations in the gases are zero. This will substantially reduce the potential for dioxin removal. As discussed above, research findings suggest oxygen is essential to dioxin formation, and lowering oxygen levels has been identified as an effective means for reducing *de novo* synthesis (Buekens *et al*, 2001). Zero oxygen in the gas is therefore likely to ensure that minimal dioxin formation occurs.

Furthermore, just over half of the SRV off-gas passes directly into what is called a "*high temperature wet scrubber*". HIsmelt process flow sheets show this acts to cool the gases from 1000 °C to 36 °C. I understand that the residence time is not known, but HIsmelt staff have confirmed that the time to cool gases to at least 100 °C is less than one second. This will clearly inhibit dioxin formation. Published information has demonstrated that cooling to at least 250 °C over one second is sufficient to minimise *de novo* synthesis.

The remaining SRV gases pass into the pre-heater system, where they are used to dry, pre-heat and partially reduce the incoming ore. Some combustion is provided through injection of a small amount of air in the fluid bed system but this is small and I understand that reducing conditions remain throughout the system. The rate of cooling through the pre-heater may not be as rapid as in the high temperature scrubber but it appears that the degree of cooling is still sufficient to minimise the potential for dioxins. A water quench is not provided in this part of the process but the in-

[5] A Buekens, L Stiegliz, K Hell, H Huang, P Segers 2001, ***Dioxins from thermal and metallurgical processes: recent studies for the iron and steel industry*** Chemosphere 42 (2001) 729-735.

coming ore (which contains 7% water) acts to quench the off-gases. HIsmelt information indicates that gas temperatures will fall from 850 to 273 °C in approximately one second in the first and second stages of the pre-heater and associated ducting, followed by further cooling in the multicyclone and water scrubber. Gases are held at high temperatures for approximately 2.5 seconds in the fluid bed reactor, but this is at a temperature of 1000 to 800 °C, which is well above the optimum *de novo* synthesis range.

The small potential for dioxin formation in the SRV off gases was demonstrated by the measurements undertaken in the HRDF. These showed concentrations of up to 0.09 $ngTEQ/Nm^3$, prior to entering the combustion system. The measurements are less than regulatory limits typically applied to the steel industry internationally (0.1 to 1 $ngTEQ/Nm^3$, for new plant and up to 80 $ngTEQ/Nm^3$, for existing plant), and also less than limits typically applied to incinerators (0.1 $ngTEQ/Nm^3$).

Some differences in the HRDF process may suggest the above measurements provide a conservative (high) indication of dioxin formation potential. Cooling in the HRDF was undertaken in water-jacket type system, which may not be as effective as the water quench provided by the high temperature scrubber and the ore pre-heater systems. The HRDF measurements were also taken from the exhaust of a fabric filter system (baghouse), which appears to have been operating at approximately 200 °C. The operation of pollution control equipment at high temperatures has been identified as a potential cause for dioxins and temperatures below 150 °C, preferably 80 °C, are necessary to minimise dioxin formation (Eduljee and Cains, 1997)[6] (Napier, 2000). The proposed plant will not employ baghouses, so it is possible that the dioxin formation potential in the proposed plant is even less than the HRDF.

5. Removal and Destruction

In addition to the low potential for dioxin formation, the proposed plant has systems in place that will both remove and destroy dioxins that may be produced.

Both routes for the SRV gas will pass through two stage water scrubbers, and a mist eliminator. These appear to be high performance units, with outlet particulate loadings of less than 5 mg/m^3, and appropriate water treatment systems. Modern, high-energy wet scrubbers employed on sinter plants have demonstrated effective levels of dioxin removal, which suggests that a portion of any dioxins that may form in the SRV gas will be removed in the scrubbers.

Finally, the cleaned SRV off gases are burnt in the waste heat recovery boiler and this is likely to destroy the small amount of dioxins that may be present. Dioxins contained in fuel or waste streams are believed to be destroyed in the high temperature regions of efficient combustion systems. I understand the boiler combustion chamber is such that combustion gases will be exposed to temperatures above 850°C for approximately 1 second. A residence time of two-seconds at 850 °C is now a common requirement for ensuring dioxin destruction in the final combustion chamber of waste incinerators (e.g. EC 2000)[7]. However, I believe the conditions will be sufficient for dioxin destruction in these circumstances, particularly given the waste gas is relatively clean, containing minimal solid particles and low dioxin concentrations.

[6] Edulje and Cains *Control of Dioxin Emissions from Waste Combustors* Filtration and Separation July/August 1997.
[7] Directive 2000/76/EC of the European Parliament and the Council of 4 December 2000 on the incineration of waste. Official Journal of the European Communities.

Therefore, given the low potential for dioxin formation in the off-gas, the potential removal of dioxins in the scrubber systems and likely destruction in the boiler combustion chamber, I do not believe the dioxin potential from the HIsmelt process is significantly greater than from a typical gas-fired utility boiler.

Yours sincerely

Philip Millichamp
Air Quality Manager

Philip Millichamp
Senior Air Pollution Engineer
Wellington

Qualifications:

BE (Chemical & Process) Canterbury University 1983

Affiliations:

Clean Air Society of Australia and New Zealand (Inc), New Zealand Branch Secretary.

Fields of Special Competence:

- Air pollution Impact Studies
- Air Emissions Monitoring
- Atmospheric Dispersion Modelling
- Air Pollution Control Technology
- Air Pollution Engineering
- Odour Assessments

Relevant Experience:

SINCLAIR KNIGHT MERZ
April 2001 to Present
Air Quality Manager, Wellington

September 1999 to April 2001
Senior Air Pollution Engineer

Recent projects include:

- *NZ Ministry for the Environment*
  Dioxin Emissions from metallurgical processes. Programme of emissions measurement and analysis of methods to control emissions for the New Zealand secondary metals industry (project commissioned June 2002).
- *Auckland Regional Council*
  Review of air discharge consent application for BHP New Zealand Steel, 2002.
- *Methanex Australia*
  Atmospheric dispersion modelling of emissions from proposed methanol complex, Western Australia, using TAPM, DISPMOD and AUSPLUME
- *NZ Ministry for the Environment.*
  Technical Specifications for a National Environmental Standard for dioxin emissions to air
- *NZ Ministry for the Environment.*
  Cost effectiveness analysis of dioxin controls. Background studies for a National environmental dioxin standard.
- *Auckland Regional Council*
  Review of air pollution control technologies for input into the Regional Plan.
- *Ministry for the Environment - NZ Ambient Air Quality Guidelines review.*
  Preparation of discussion document on their use and a proposed approach for new guidelines.

OTAGO REGIONAL COUNCIL
1996 - 1999
Air Pollution Specialist

Selected Assignments:

- Management of Otago region air emissions inventory study for transport, industrial and domestic sources - 1998 – 1999.
- Set up and management of Otago region ambient air monitoring program, 1996 – 1999.
- Technical input to preparation of the Proposed Otago Regional Plan Air, 1998 - 1999.
- Expert evidence to Environment Court on behalf of Otago Regional Council on discharge of sulphur dioxide, fluoride, particulate and odour from superphosphate fertiliser works. Ravensdown Fertiliser Co-operative Ltd and Gary Melvyn Smith verses Otago Regional Council 1998 -1999.
- Audit of consent application and recommendations for discharges to air from large open cast mine expansion by Macraes Mining Ltd,1996.
- Audit of consent application and recommendations for discharges to air from Dunedin City Council waste water treatment plant at Green Island Dunedin.
- Audit of applications from ferrous and non-ferrous foundries. Including recommendations for air pollution control equipment. 1996 - 1998.
- Design of community odour surveys – 1997.

DSIR AND ENVIRONMENTAL SCIENCE AND RESEARCH LTD
1991 - 1996
Air Pollution Consultant

Selected Assignments:

- *Chemical, Process and Fertiliser Industry*
  - Urea discharge measurements from urea scrubber at ammonia urea plant, Petrochemical Corporation of NZ Ltd.,1995.
  - Dioxin and furan emissions measurements from chlorine plant at ICI Botany site, Sydney, 1995.
  - Dioxin, furan, trichlorophenol and VOC emissions monitoring, atmospheric dispersion modelling and ambient air monitoring programs for chemical manufacturing process, DowElanco Ltd. New Plymouth 1994.
  - Expert advice to Canterbury Regional Council on Ravensdown Fertiliser's application for air discharge consents, 1992, including preparation of expert evidence to Council Hearing and Environment Court.
  - Emissions measurements of fluoride and reduced sulphur compounds from Ravensdown Hornby 1992.

- *Aluminium and Metallurgical Industry*
  - Emissions measurements of fluoride, particulate, particulate size range and sulphur dioxide from pot room and carbon bake facilities, Main stack New Zealand Aluminium Smelters Ltd. Evaluation of potential sampling planes for instrumental monitoring location, 1995.

- Emissions measurements of particulate, atmospheric dispersion modelling and preparation of Assessment of Environmental Effects for wheel casting operations. Ford Alloy Wheel Plant 1993.

- *Power and Gas*
  - Preparation of Assessment of Environmental Effects for methanol manufacturing. Management of project, including emissions measurements of reformer, distillation columns and cooling tower droplet drift, atmospheric dispersion modelling of all sources and ambient air monitoring programme design and completion. Methanex Waitara Ltd., 1995.
  - Preparation of Assessment of Environmental Effects for natural gas treatment plant. Management of project, including emissions measurements of boilers, compressors, carbon dioxide stripping columns and glycol recovery systems, atmospheric dispersion modelling or all sources and ambient air monitoring programme design and completion. NZ Natural Gas Corporation, 1995.
  - Atmospheric dispersion modelling of combustion emissions from four Malaysian thermal power stations operating on coal oil and gas. Chimney height design for a range gas turbines; air quality part of environmental audit of Port Klang power station. Tenaga Nasional Berhard, SDN BHD, Malaysia 1994.
  - Atmospheric dispersion modelling of methanol emissions from distillation column Methanex Motonui Ltd., 1994.
  - Preparation of Assessment of Environmental Effects for synthetic gasoline manufacturing facility. Co-manager of project involving emission measurements of reformers, MTG heaters and cooling tower droplet drift; atmospheric dispersion modelling of all sources; and ambient air monitoring program. Methanex Motonui Ltd., 1993.
  - Pilot plant studies for limestone absorption of sulphur dioxide for Electricity Corporation of New Zealand, 1992.

- *Geothermal*
  - Audit of resource consent application from Ohaaki geothermal power station for Environmental Waikato, 1994.
  - Audit of resource consent application from Rotokawa geothermal power station for Environment Waikato, 1994.

- *Wood Fibre Industry*
  - Audit of resource consent application for medium density fibre board plant from Rayonier New Zealand Ltd., Mataura. Southland Regional Council, 1994.
  - Emissions measurements of particulate and formaldehyde, and atmospheric dispersion modelling of all emissions from medium density fibre board plant. Nelson Pine Ltd. 1994.
  - Emissions measurements of combustion products and reduced sulphur compounds and atmospheric dispersion modelling of all sources from a Kraft pulp and paper mill. New Zealand Forest Products Ltd. Kinleith, 1994.
  - Emissions measurements of particulate, particulate size range, combustion products, heavy metals and reduced sulphur and VOCs from a Kraft pulp and paper mill. Tasman Pulp and Paper Ltd., Kawerau.

- Formaldehyde emissions measurements from timber drying kilns, Tasman Lumber Ltd., Kawerau 1994.
- Formaldehyde and particulate emissions measurements from triboard mill, Juken Nissho Ltd., Masterton, 1993-94.
- Particulate and fibre measurements from thermo-mechanical pulp mill, Pan Pacific Forest Industries Ltd., Whirinaki, 1992.

- *Incineration*
  - Preparation of Assessment of Environmental Effects (AEE); dioxin, furan, particulate, heavy metals and acid gas emissions measurements and atmospheric dispersion modelling of emissions from medical waste incinerator at Shelly Bay, Wellington. Mediwaste Wellington Ltd. 1994.
  - Dioxin, furan particulate, heavy metals and acid gas emissions measurements from medical waste incinerator at Princess Margaret hospital Christchurch, Palmerston North hospital and New Plymouth hospital for regional health authorities. 1992 -1994.
  - Dioxin and furan emissions measurements from solid and liquid chemical waste incinerators. Dow Elanco 1993.

- *Odour*
  - Preparation of odour assessment part of AEE for meat processing site, including engineering assessment of rendering plant, tannery, waste water treatment and control equipment. AFFCO Imlay Ltd. Wanganui 1995.
  - Olfactometrey and VOC emissions measurements, atmospheric dispersion modelling and preparation of AEE for carpet underlay manufacturing process. Feltex Rubber, Lower Hutt, 1995.
  - Olfactometry measurements from rendering plant and biofilter. Biofilter performance assessment. Advanced Foods NZ Ltd, Waipukurau, 1994.
  - Hydrogen sulphide measurements and odour assessments of tannery and fellmongery operations, Hawkes Bay Hyde Ltd. 1995.
  - Preparation of odour assessment part of AEE for meat processing site, including engineering assessment of rendering plant, tannery, waste water treatment and control equipment. AFFCO Wairoa Ltd., 1994.
  - Odour source assessment and odour control recommendations for animal rendering plant. Waikato by-products Ltd., 1993.
  - Odour assessments and preparation of AEE for Wellington waste water treatment plant, Moa Point, Wellington City Council,1992.

- *Surface Coating*
  - Emissions monitoring of VOCs, dispersion modelling engineering evaluations and preparation of AEE for drum manufacturing operation. Rheem NZ Ltd. Tawa, 1993-94.
  - Emissions monitoring of VOCs, dispersion modelling and preparation of AEE for motor vehicle assembly plant, Vehicle Assemblers NZ Ltd., 1993.
  - Emissions monitoring of VOCs and dispersion modelling for offset web printing process, ANZPAC NZ Ltd., Napier 1993.

- *Expert Evidence to Environment Court*
  - Ravensdown Fertiliser Ltd. and Gary Melvyn Smith, 1998-99. Discharges of sulphur dioxide and other contaminants associated with fertiliser manufacture.
  - Medical Officer of Health verses Canterbury Regional Council and Ravensdown Fertiliser, 1994. Discharges of sulphur dioxide and other contaminants associated with fertiliser manufacture.
  - Wellington City Council verses local residents, 1993. Odours from proposed northern landfill.
  - Te Aroha Air Quality Protection Appeal Group verses Waikato Regional Council, 1993. Odours from animal rendering plant.

DEPARTMENT OF HEALTH, WELLINGTON

1985 – 1991

Air Pollution Scientist

- Regulatory control of a large range of air discharges, including three fertiliser works in Napier, Wanganui and New Plymouth. Attendance at numerous acid plant cold-starts, fluoride and particulate measurements from den scrubber stacks, and general evaluation of air pollution impacts.
- Air pollution control equipment evaluations including chemical scrubbers, afterburners and biofilters. Evaluation of high efficiency cyclone and fabric filter performance for pulverized coal fired boiler plant.

Publications:

- P.E. Millichamp "Odour Management Under the New Zealand Resource Management Act – Two Case Studies" Proceedings of ENVIRO 2000, Sydney, April 2000.
- P.E. Millichamp "Seven Years Experience of Air Quality Management Under New Zealand's Resource Management Act" Proceedings of the 14th International Clean Air & Environment Conference, Melbourne October 1998.
- B.W.L. Graham, A.G Bingham and P.E. Millichamp "Assessment of Air Emissions from a Pulp and Paper Mill" Proceedings of the Annual Exhibition and Conference of the Technical Association of the Australian and New Zealand Pulp and Paper Industry Inc. (Appita) 1996.
- R. Pilgrim, M Bulley, P Millichamp, M Bird "Incineration of Hazardous Wastes in New Zealand" Conference Proceedings of the 10th International Clean Air Conference of the Clean Air Society of Australia and New Zealand, Auckland NZ, March 1990.
- M.J. Bird PE Millichamp "The Sources and Control of Odorous Emissions from a Lubricating oil re-refining Plant" Clean Air Volume 23, No. 3 August 1989
- P.E. Millichamp "Flue Gas Desulphurisation in New Zealand Pulverised Coal Fired Boilers A Theoretical Discussion" Proceedings of Coal Research Conference, Wellington NZ, October 1988.
- R.C. Pilgrim and P.E. Millichamp "Control of Flue Dusts from Burning Pulverised Coal in Industrial Boilers" Proceedings of Coal Research Conference, Wellington NZ., October 1985.

Philip Millichamp is a chemical and process engineer with over 17 years experience in the air pollution field. This has includes a substantial amount of experience in the assessment of dioxin and furan emissions to air. He has worked on a large number of projects where dioxin emissions are a concern, dating back to issues associated with the manufacture of 2,4,5-T in New Plymouth (NZ) in the late 1980s. Philip has undertaken dioxin and furan measurements from a large range of industrial processes and incinerators. From 1991 to 1996 he was employed by the Institute of Environmental Science and Research Ltd., which until recently was the only organisation in the Southern Hemisphere with capability to analyse ultra-trace quantities of dioxins. Since joining Sinclair Knight Merz Philip has been involved with a number of dioxin emission evaluations and has contributed to the development of national policy on dioxin controls through various contracts with the NZ Ministry for the Environment.