Proposed Synthetic Rutile Plant Expansion

Narngulu Industrial Estate Geraldton

AMC Mineral Sands Ltd

Report and Recommendations

of the

Environmental Protection Authority

Environmental Protection Authority
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Summary and recommendations

AMC Mineral Sands Ltd, the mineral sands division of Renison Goldfields Consolidated Limited, proposes to expand its synthetic rutile plant on the Narngulu Industrial Estate located 11 km south-east of Geraldton (Figure 1). After expansion, the synthetic rutile plant will occupy some 47 hectares of the 465 hectare Estate (Figure 2). The expansion will increase synthetic rutile production from 112,500 to 260,000 tonnes per annum. This expansion arises from an increased demand for the synthetic rutile product.

A Public Environmental Report was submitted to the Environmental Protection Authority by the proponent in August 1989 and was released for public review for an eight week period beginning on Monday, 14 August 1989 and finishing on Friday, 6 October 1989. Four submissions were received from the public and government agencies. No submission suggested that the environmental impacts of the project were unmanageable.

The Environmental Protection Authority has assessed the potential environmental impacts of the proposal utilising the Public Environmental Report and additional information supplied by the proponent and in the submissions from public and Government agencies. The Environmental Protection Authority notes the list of commitments that the proponent has made in the Public Environmental Report in response to issues raised in submissions and questions from the Environmental Protection Authority. This includes an unreserved commitment to achieve all the standards of environmental management required. A number of specific commitments relate to exhaust gas emissions; water treatment; noise; iron oxide disposal; dust control; and monitoring programmes.

The potential environmental impact of greatest concern with this proposal is its potential to emit hydrogen sulphide to the atmosphere. The company had major hydrogen sulphide problems in 1987, necessitating the issue of a pollution abatement notice by the Environmental Protection Authority and the operation having to close down to install new pollution control equipment. It has since complied with the Environmental Protection Authority's air emission requirements. The company has in this proposal committed itself to further upgrading the equipment to a higher standard, particularly in relation to the control of hydrogen sulphide odours.

A monitoring programme for stack emissions, leachate from evaporation ponds, groundwater and off-site noise will be undertaken by the proponent.

This programme will be prepared by the proponent prior to commissioning the expanded operations. It will address the manner in which monitoring is to be conducted including the types of tests and frequency with which they will be performed. It will also include specific reference to testing for sulphur dioxide, hydrogen sulphide and particulate (dust) emissions from the stack.

The monitoring programme will be aimed at ensuring the initial commissioning phase and subsequent operations of the plant meet all commitments and recommendations, to the satisfaction of the Environmental Protection Authority.

As with the existing operation most feedstocks will arrive by rail. The final product will be railed to Geraldton wharf for export.

The Environmental Protection Authority considers the project to be environmentally acceptable subject to commitments given by the proponent, in the Public Environmental Report and in response to subsequent questions raised in the submissions (Appendix 2), and to the Authority's recommendations in this Report.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal as described in the Public Environmental Report is environmentally acceptable and recommends that it could proceed subject to the Environmental Protection Authority's recommendations in this Report and the commitments made by the proponent (consolidated in Appendix 1) and responses to subsequent questions (Appendix 2).

The proposed method of controlling the odour problems previously experienced at the existing operation is to pass the kiln off-gases through an afterburner that will oxidise hydrogen sulphide to sulphur dioxide then the sulphur dioxide will be removed by a combination venturi scrubber and packed tower.

The Authority notes the commitments by the proponent for minimising sulphur dioxide emissions and considers that maintenance of the pollution control equipment is crucial to achieving these low levels. Accordingly the Authority makes the following recommendation.

Recommendation 2

The Environmental Protection Authority recommends that sulphur dioxide emission levels from the expanded operations of the synthetic rutile plant are managed by keeping the pollution control equipment in good operational order and as detailed in the Public Environmental Report, to the satisfaction of the Environmental Protection Authority.

The Authority considers that dust levels should be controlled to minimise potential environmental impacts. The proponent has made commitments to minimise dust emissions from the plant such that the

Authority's air quality objectives for the Narngulu Industrial Estate and nearby residential areas will be achieved. Accordingly the Authority makes the following recommendation.

Recommendation 3

The Environmental Protection Authority recommends that particulate matter (dust) emission levels from the expanded operation are managed, as detailed in the Public Environmental Report, to the satisfaction of the Environmental Protection Authority.

In recognition of the importance of the waste gas systems, waste liquid and solid systems and other measures taken to ensure any potential environmental impacts are managed. Contingency plans should be available to minimise any potential environmental impact if the waste management facilities do not continually achieve their expected level of effeciency. The Authority recommends the following to augment the commitments given by the proponent.

Recommendation 4

The Environmental Protection Authority recommends that prior to commissioning of the expanded facility the proponent should prepare contingency plans for the waste management facilities, to the satisfaction of the Environmental Protection Authority.

Further to the commitments made by the proponent the Authority recommends the following in order to ensure that adequate controls are established, the monitoring programmes are capable of providing the level of environmental protection they are designed for, and that any problems identified are rectified.

Recommendation 5

The Environmental Protection Authority recommends that prior to the commissioning of the new expanded facility the proponent submit, and subsequently implement a monitoring programme for the bores, pipeworks beneath the ponds, dust, noise and stack emissions, to the satisfaction of the Environmental Protection Authority, which will include:

- **water quality parameters such as pH, total dissolved salts, iron;**
- **baseline sampling prior to commissioning;**
- **details of sampling sites, times and frequency of reporting to the Environmental Protection Authority; and**
- **a commitment to modify the environmental management programme if the Environmental Protection Authority considers it necessary.**

1. Introduction

AMC Mineral Sands Ltd, the mineral sands division of Renison Goldfields Consolidated Ltd, proposes to expand its synthetic rutile plant. After expansion the synthetic rutile plant will occupy some 47 hectares of the 465 hectare Narngulu Industrial Estate. The expansion will increase the production of synthetic rutile at the site from 112,500 to 260,000 tonnes per annum. This expansion arises from an increased demand for the synthetic rutile product.

The existing plant was completed in 1987 under the terms and conditions of the Mineral Sands (Western Titanium) Agreement Act 1975. The Act has since been amended, and is now entitled the Mineral Sands (Eneabba) Agreement Act 1975-1988.

Western Titanium Limited commenced mining mineral sands at Capel in 1956 to produce ilmenite, a mineral composed of mixed oxides of titanium and iron. By 1975, Western Titanium had commenced mining and separating mineral sands at Eneabba. In 1977, it merged with Associated Minerals Consolidated Limited. By 1985, as a result of favourable market conditions, Associated Minerals Consolidated Ltd put forward a proposal to build a further rutile plant at Narngulu. This plant was completed in early 1987. In 1989 the company name was changed to AMC Mineral Sands Ltd (AMC).

A Public Environmental Report was submitted by the proponent in August 1989 and was released for public review for an eight week period beginning on Monday, 14 August 1989 and finishing on Friday, 6 October 1989. Four submissions were received from the public and government agencies. The Shire of Greenough conditionally supported the project.

2. The proposal

2.1 General

The proposal involves expanding the capacity of the synthetic rutile plant at Narngulu, near Geraldton from 112,500 tonnes per annum to 260,000 tonnes per annum.

This will involve expanding and upgrading all sections of the plant to handle the increased materials flow.

Specifically, the proposal includes:

- upgrading the existing kiln line and installation of a second kiln line;
- extension of the aeration plant;
- extension of rail handling facilities;
- extension of the leach plant;
- upgrading and duplicating the gas cleaning system to remove hydrogen sulphide and other emissions;
- upgrading and expansion of the water treatment plant; and
- extension of iron oxide disposal facilities.

The process basically consists of two stages. The first stage involves feeding measured quantities of ilmenite and coal into a rotating kiln to reduce iron oxide to its metallic form. The intermediate product, reduced ilmenite, is then further treated to remove the metal iron. The final product is the synthetic rutile. Chemically the synthetic rutile is high in titanium dioxide and low in iron.

The proponent is taking the opportunity afforded by the expansion to significantly upgrade environmental controls of the plant. It is expected that the environmental performance of the expanded operation will be better than that of the existing operation. Particular attention is being given to increasing the efficiency for removing odorous gases, which include hydrogen sulphide, from the emissions. To achieve this, the expanded plant will employ an afterburner and packed tower of advanced design, together with other necessary gas cleaning equipment. In addition, the existing waste gas system will be upgraded to this advanced performance specification. This will result in an overall improvement in the control of hydrogen sulphide and sulphur dioxide emissions from the plant.

Computer modelling of stack emissions by the proponent's consultants show that if the sulphur dioxide design emission concentrations of less than 50 parts per million is achieved, then the predicted maximum ground level concentration of sulphur dioxide is less than 15 micrograms per cubic metre. This level can be compared with the soon to be published draft Environmental Protection Policy for the Kwinana region that includes an objective for a one hour average ground level concentration of 350 micrograms per cubic metre in residential areas.

A water recycling and recovery system using reverse osmosis technology has been successfully employed at the existing operation and will be upgraded so that the overall water requirements on the site will continue to be minimised.

Iron oxide, a solid waste product of the process, will be wetted to facilitate its discharge into plastic lined dams and dried by solar radiation. The proponent has advised the Authority that the existing land available for iron oxide disposal, ie 40 hectares, will allow for a project life of about twenty years. This is based on one dam being filled and rehabilitated annually by covering with a thick layer of topsoil.

2.2 Site location

The Narngulu Industrial Estate, 11km south-east of Geraldton is an appropriate site for a mineral sands processing plant in the Geraldton District. The estate:

- was established for the purpose of accommodating general industries and mineral sands processing plants;
- has the necessary road and rail access required by the project, with connection to the direct rail link between Eneabba and the Port of Geraldton. Road access to and from the Brand Highway does not impact on either Geraldton or Narngulu town sites;
- has ready access to the proponent's existing port facilities at Geraldton for the export of product;
- is close to a major regional centre which provides adequate service facilities for the project and housing for employees; and
- already accommodates the Narngulu Minerals operations of AMC which will source all of the ilmenite feedstock for the plant expansion. An expansion of the existing plant on the existing site, making continued use of the estate, is considered appropriate by the Environmental Protection Authority.

2.3 Potential environmental impacts identified in the public environmental report

The Public Environmental Report identified the following potential impacts from the proposal:

Air quality

Excessive hydrogen sulphide emissions were the principal cause of complaints during the odour problems encountered at the commissioning of the existing operation in early 1987. These levels exceeded eg. (measured levels of between 52 and 222 ppm hydrogen sulphide) those considered acceptable to the Environmental Protection Authority and resulted in the company being issued a Pollution Abatement Notice. This required the proponent to install new equipment, to rectify the odour problems before the end of December 1987. Sulphur dioxide is also a waste gas emission and is capable of both potential occupational and environmental impacts, including contamination of groundwater, and human health implications.

Easterly winds have the potential to carry the undesirable odorous gases, if emitted, over housing areas and the Brand highway. The proponent has taken appropriate steps to ensure these emissions will not occur in the future by installing an afterburner, packed tower and gas cleaning system. It is also committed to upgrading the pollution control equipment of the existing operation to that proposed for the expanded operation.

Dust generated at various steps in the synthetic rutile process can also cause environmental impacts. The proponent has therefore installed enclosed conveyor systems with dust collection equipment. Also storage bins are used in preference to stockpiles for containment of the ilmenite feed and coal used in the process to further minimise the generation of dust.

Noise

The Narngulu Industrial Estate comprises several operations covering a wide geographical area which is set aside for such industrial activities. Many of these operations are continuous with a consequent increase in background noise levels in the vicinity of the estate.

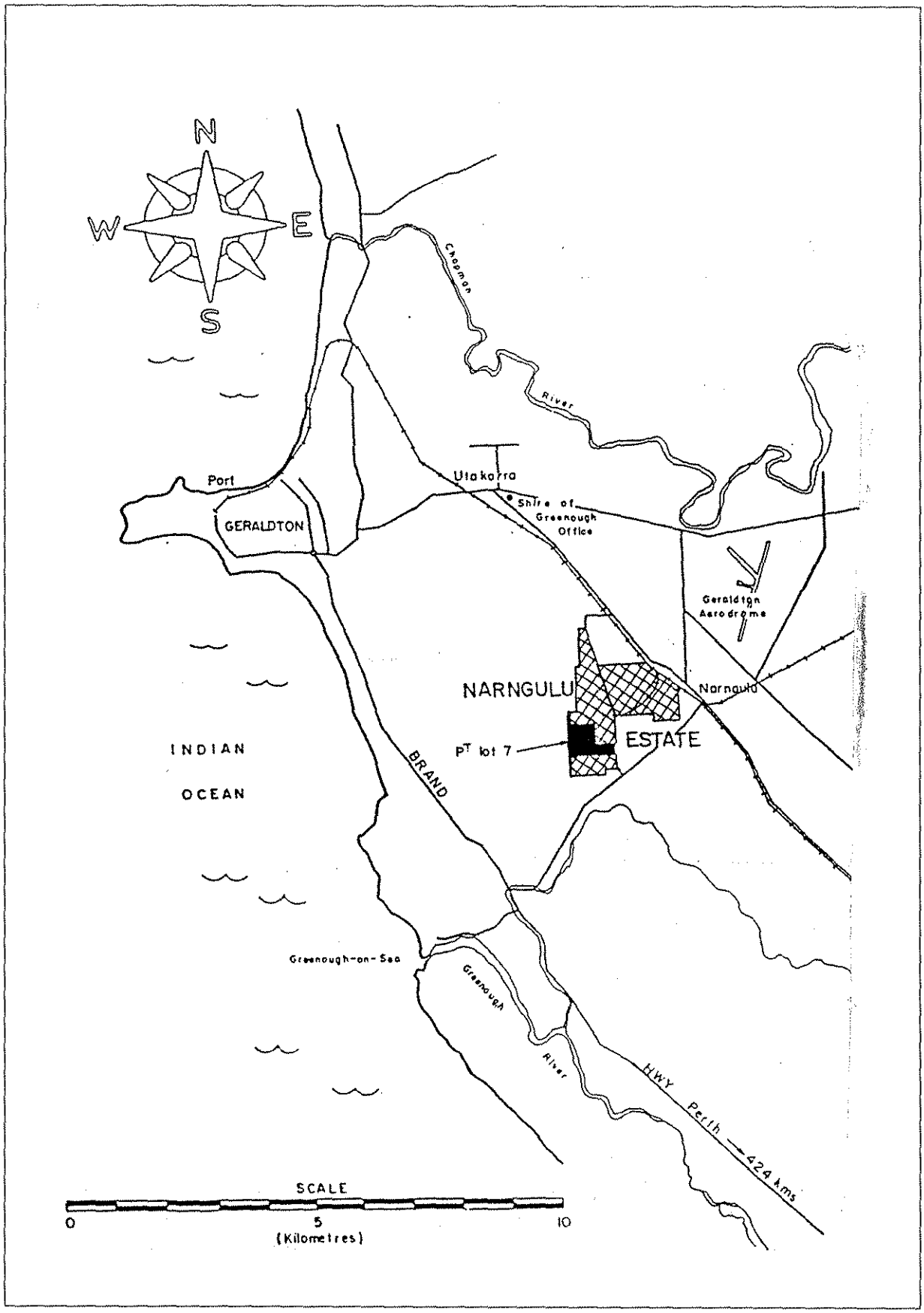
The proponent has offered to conduct off-site noise level monitoring while it is performing an on-site occupational noise monitoring programme. The information will be made available to the Environmental Protection Authority for their information. The information is expected to assist the Environmental Protection Authority when it makes its assessment of the expanded operations compliance to commitments and recommendations listed in this report.

Wastes

The proponent has a reverse osmosis liquid waste system that treats, recovers and recycles wastewater at the plant. Any solids from this process are pumped into double lined plastic evaporation ponds and solar dried. A system of pipeworks under the ponds is used to monitor the integrity of the liners and recover liquid in the event of a leakage. This process effectively eliminates the need for liquid waste to be discharged into the environment.

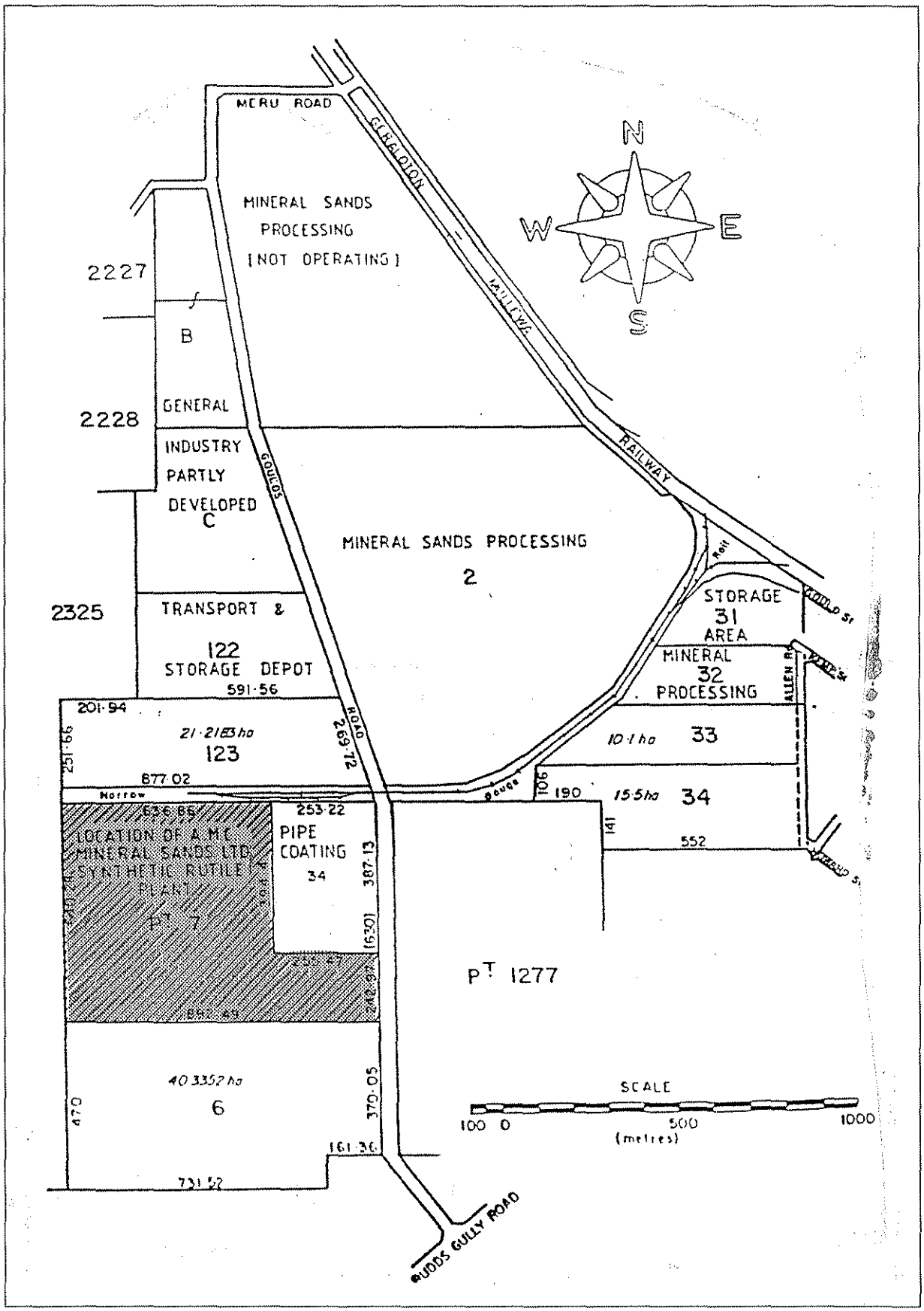
The proponent plans to handle solid waste disposal from the expanded plant using management practices currently used in the existing plant.

These include maintaining the fine rusted iron (iron oxide) waste in a wet form at all times from its generation through to its ultimate disposal in plastic lined dams. Both the evaporation ponds, used for the water recovery and recycle system, and these dams for iron oxide disposal will be rehabilitated when filled, to the satisfaction of the Environmental Protection Authority.



Source: PER

Figure 1: Regional location Narngulu Industrial Estate



Source: PER

Figure 2: Site location within Narngulu Industrial Estate

3. Summary of public and Government agency submissions

3.1 Introduction

During the eight week public submissions period a total of four submissions on this proposal were received by the Environmental Protection Authority. Names of contributors are given in Appendix 3. Most submissions indicated hydrogen sulphide emissions as the main potential environmental concern. No submission suggested that the environmental impacts of the project are unmanageable. The Environmental Protection Authority appreciates the time and effort required to make a submission and commends those that participated in providing valuable input to the assessment of this proposal.

3.2 Specific issues raised in submissions

The submissions raised questions about some issues which were not adequately detailed in the original Public Environmental Report. The issues referred to concerns over noise, dust and odour levels expected from the expanded operation through to personal safety and the greenhouse effect. Appendix 2 contains the list of questions asked of the proponent and the proponent's responses.

The issues raised in submissions may be broadly summarised as follows:

- susceptibility of the pollution control equipment to failure during power fluctuations;
- the adequacy of regular as opposed to continuous monitoring programmes and the need for a separate programme at the commissioning stage;
- the provision for dust control at the wharf while loading ships and during the transport of all products to and from the plant;
- the effect of increased road and rail transport;
- a request for a community liaison committee to review the monitoring programme and any complaints which may arise;
- the need for a greenhouse gas assessment for the expanded operations;
- description, assessment and method of treatment afforded the radioactive elements in the process;
- the consideration of alternative energy sources to coal;
- concern that noise levels from the expanded operation may require action; and
- concern for adequate protection of workers handling synthetic rutile.

3.3 Proponent's response to issues raised

The proponent considers that the issues raised in the submissions have been answered by the information contained in the Public Environmental Report, written responses to issues raised in the submissions (Appendix 2) and further commitments listed in the Consolidated Commitments (Appendix 1).

The proponent contends that they have solved the odour problem which created a furore of complaints and culminated in a petition signed by some three hundred persons. In the twenty three months since installing equipment to solve the odour problem, a few complaints have been received. The proponent took action to ensure these complaints were investigated and resolved to prevent a major odour problem from recurring.

The proponent has answered some of the issues raised in the submissions with commitments. These include commitments to extend its radiation monitoring programme and the monitoring programme for nuisance dust and inhaled particulates.

The proponent's response to the other issues raised are presented in Appendix 2. The proponent notes that the expansion has been carefully planned and includes an upgrade of the existing waste gas system at the same time as installation of a new improved waste gas system. This improvement will enable better waste gas management and potentially result in a better air quality from the emissions of the expanded plant than is presently achievable from the existing facility.

4. Environmental impacts identified by the Environmental Protection Authority

4.1 Introduction

The Environmental Protection Authority has identified the following aspects as those with the potential to cause impacts; hydrogen sulphide emissions (odour), other gas emissions, dust, noise, wastes (liquid and solid), and groundwater usage.

The Environmental Protection Authority considers the project to be environmentally acceptable and that it could proceed subject to the commitments given by the proponent and in response to subsequent questions (Appendix 2) and to the Authority's recommendations in this report.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal as described in the Public Environmental Report is environmentally acceptable and recommends that it could proceed subject to the Environmental Protection Authority's recommendations in this Report and the commitments made by the proponent (consolidated in Appendix 1) and responses to subsequent questions (Appendix 2).

4.2 Stack emissions

The Authority notes the commitments by the proponent to improvements for controlling emissions from the synthetic rutile plant.

In view of the previous odour problems encountered by the proponent at the commissioning of the existing plant and the time taken to satisfactorily resolve the problems encountered, the Authority has been careful to ensure adequate controls are in place to prevent similar problems from occurring with the new expanded operation.

The design parameters of the waste gas system, based on both theory and operating experience, will result in the hydrogen sulphide and reduced sulphur compounds being converted to sulphur dioxide in the afterburners. Over 95% of the total sulphur dioxide in the waste gas system will then be removed by the Venturi and packed tower scrubbers under all operating conditions.

In stack emission computer modelling commissioned by the proponent, the predicted maximum ground level concentration of sulphur dioxide was less than 15 micrograms per cubic metre. This result was predicted based on the expanded operation achieving its design emission specification of less than 50 parts per million sulphur dioxide. The model was also used to test a worst case scenario in which the sulphur dioxide emission levels were 10 times the 50 parts per million level, ie 500 parts per million. The predicted maximum ground level sulphur dioxide concentration was still less than 150 micrograms per cubic metre. These modelled emission levels occurred at a distance of 500 metres from the stack, which is within the plant boundaries.

The Authority considers sulphur dioxide concentrations at ground level should be as low as possible, this has been indicated in the soon to be published draft Environmental Protection Policy for the Kwinana region. The Policy includes an objective for a one hour average ground level concentration of 350 micrograms per cubic metre in residential areas.

The Authority's investigations conclude that the proposed waste gas system will provide improved control over the stack emissions. It will potentially result in a better air quality from the emissions of two stacks than is presently achievable from the existing single stack.

The existing facility currently operates within the minimum air quality requirements of the Environmental Protection Authority. The expansion and upgrade of the waste treatment system offers the potential to operate at a level significantly better than the minimum required by the Environmental Protection Authority.

The Authority's air quality objectives with regard to sulphur dioxide concentrations at the Narngulu Industrial Estate and nearby residential areas are as follows:

	Averaging period	Standard	Limit
Narngulu Industrial Estate	1 hour	700	1400
Nearby residential areas	1 hour	350	700

The levels of sulphur dioxide are expressed in micrograms per cubic metre of dry air at zero degrees Celsius and one atmosphere pressure (101.325 kilopascals).

The objective does not imply that each source of sulphur dioxide emissions can emit this value. They relate to the cumulative emissions from an area and represent an assimilative threshold for sulphur dioxide.

Predicted sulphur dioxide emissions from the expanded operation are expected to be less than 15 micrograms per cubic metre, as detailed in the proponents Public Environmental Report, and will easily achieve these objectives and allow for future development within the Narngulu Industrial Estate.

Recommendation 2

The Environmental Protection Authority recommends that sulphur dioxide emission levels from the expanded operations of the synthetic rutile plant are managed by keeping the pollution control equipment in good operational order and as detailed in the Public Environmental Report, to the satisfaction of the Environmental Protection Authority.

The oxidation of hydrogen sulphide to sulphur dioxide in the afterburner will effectively control the

rotten egg odour which has previously been an issue of complaint about the existing plant.

4.3 Waste treatment

The Authority has recently reviewed waste treatment facilities on the existing plant and approved them for operation.

As noted in the Public Environmental Report by the proponent "the site is not suitable for the disposal of liquid effluent". Consequently a liquid waste system for water recovery and recycling has been developed to "minimise the overall site water requirements since water is a valuable commodity, especially in the Geraldton region".

In addition the proponent advised the Authority that its present scheme water allocation from the Water Authority of WA should be sufficient to provide the water requirements of the expanded operation. No groundwater will be extracted by the proponent for the process due to the poor quality and availability of the groundwater in the area.

The liquid waste system is a water recovery and recycle system, which includes neutralisation, clarification, microfiltration and hypochlorite dosing used to eliminate bacterial growth. A reverse osmosis process is used for final treatment of the liquid waste. The only water that returns to the environment is that evaporated by solar heating from the plastic lined evaporation ponds.

A programme will be designed to prevent contamination of the groundwater through regular testing of both the water collected in pipes beneath the ponds and from surrounding bores after consultation with the Water Authority of WA.

The waste management facilities proposed in the Public Environmental Report are considered adequate to manage the environmental impacts identified in this report. In the event of a waste management system not achieving the expected operating level of efficiency, the Authority considers that adequate contingency plans should be available for implementation.

Recent Environmental Protection Authority site inspections indicated that disposal practices for some solid wastes, in particular sinter, resulted in the generation of dust. The proponent has addressed the situation as explained in Appendix 2 (m) and resolved this dust problem. Dust can also be generated from the transfer of feed materials and the dried surface of dams.The Authority's air quality objectives with regard to particulate matter (dust) concentrations at the Narngulu Industrial Estate and nearby residential areas are as follows

	Averaging period	Standard	Limit
Narngulu Industrial Estate	24 hours	150	260
Anywhere	15 minutes	-	1000
Nearby residential areas	24 hours	90	150

The levels of dust (particulate matter) are expressed in micrograms per cubic metre of air at zero degrees Celsius and one atmosphere pressure (101.325 kilopascals).The objective does not imply that each dust source can generate that level of dust. The levels relate to the cumulative emissions for an area and represent a threshold for dust levels.

The Environmental Protection Authority considers that dust levels should be controlled to minimise potential environmental impacts and recommends the following.

Recommendation 3

The Environmental Protection Authority recommends that particulate matter (dust) emission levels from the expanded operation are managed, as detailed in the Public Environmental Report, to the satisfaction of the Environmental Protection Authority.

The disposal of iron oxide as a slurry mix to plastic lined dams will be continued. These dams have been used by the proponent in the existing operations successfully and when filled will be covered with topsoil and the area returned to its original state.

In view of the number of environmental control systems ie. liquid, solid and gas, required to ensure the expanded operation can provide the level of environmental assurance the Environmental Protection Authority requires. It is expected that the proponent would need to have backup or shutdown procedures in place.

For example, should the waste gas pollution control equipment fail, the proponent will be required to have a contingency plan available that effectively shuts down the kiln.

Recommendation 4

The Environmental Protection Authority recommends that prior to commissioning of the expanded facility the proponent should prepare contingency plans for the waste management facilities, to the satisfaction of the Environmental Protection Authority.

4.4 Noise

The noise generated from the existing operations has not been a subject of concern to date. The proponent believes the noise specifications included in equipment tenders has been a contributing factor in obtaining an overall acceptable noise level. The machinery to be purchased and used in the expansion phase will also contain strict noise specifications which the proponent believes will help in the control of any foreseeable noise impacts.

The proponent offered to conduct off-site noise level monitoring in its Public Environmental Review. The information will be used for future land use consideration and to ensure noise levels off-site are not a cause of adverse environmental impacts.

The proponent has confirmed that they will conduct off-site noise measurements and has advised the Environmental Protection Authority that the results will be reported in the monitoring programme.

4.5 Monitoring and management

Monitoring and management of the waste treatment systems is critical to the successful operation of the expanded operation.

In order to ensure that the commitments made in the Public Environmental Report and recommendations contained in the Authority's Report are able to be properly monitored and managed, the Environmental Protection Authority recommends the following.

Recommendation 5

The Environmental Protection Authority recommends that prior to the commissioning of the new expanded facility the proponent submit, and subsequently implement a monitoring programme for the bores, pipeworks beneath the ponds, dust, noise and stack emissions, to the satisfaction of the Environmental Protection Authority, which will include:

- **water quality parameters such as pH, total dissolved salts, iron;**
- **baseline sampling prior to commissioning;**
- **details of sampling sites, times and frequency of reporting to the Environmental Protection Authority; and**
- **a commitment to modify the environmental management programme if the Environmental Protection Authority considers it necessary.**

5. Conclusion

AMC Mineral Sands Ltd proposes to expand its existing Synthetic Rutile Plant located in the Narngulu Industrial Estate at Geraldton (see Figures 1 and 2).

The expansion will more than double the processing capacity of the plant from 112,500 tonnes to 260,000 tonnes per annum. The reason for expansion is an increased demand for the synthetic rutile product.

AMC Mineral Sands Ltd previously proposed an expansion of their existing heavy mineral sand mining operation at Eneabba West to accommodate the increased need for ilmenite at the Synthetic Rutile plant. That proposal also considered expansion of the dry processing plant at Narngulu Geraldton and the Environmental Protection Authority's report and recommendations can be found in Bulletin 403.

Based on the information supplied in the Public Environmental Report, responses to questions and submissions and investigation by the Environmental Protection Authority, the Environmental Protection Authority concludes that the project is environmentally acceptable and considers that it could proceed subject to the information in the Public Environmental Report, all commitments given and the Environmental Protection Authority recommendations in this Report.

Appendix 1

Consolidated commitments numbered 1 to 11 for the Narngulu synthetic rutile plant expansion

Waste Treatment

1. The proponent commits itself to containing all operational process waters on-site and on a continuous basis, to the satisfaction of the Environmental Protection Authority.

2. The proponent commits itself to containment of neutralised effluent in evaporation dams to prevent effects on groundwater, to the satisfaction of the Environmental Protection Authority.

Iron Oxide Disposal

3. The proponent commits itself to the disposal of iron oxide in lined dams, to the satisfaction of the Environmental Protection Authority.

Dust Control

4. The proponent commits itself to the control of dust emissions at all times, to the satisfaction of the Environmental Protection Authority.

Noise

5. The proponent commits itself to controlling operational noise levels at all times such that there is no off-site impact, to the satisfaction of the Environmental Protection Authority.

Exhaust Gas Emissions

6. The proponent commits itself to controlling gas emissions at all times, to the satisfaction of the Environmental Protection Authority.

Monitoring

7. The proponent commits itself to regular monitoring of dams for leakage and to regular monitoring of water bores to ensure that groundwater quality is not affected, to the satisfaction of the Water Authority of WA and the Environmental Protection Authority.

8. The proponent commits itself to independent stack monitoring for particulates and gases, to the satisfaction of the Environmental Protection Authority.

9. The proponent commits itself to extending the existing radiation monitoring programme to the satisfaction of the Department of Mines.

10. The proponent commits itself to extending the monitoring programme for nuisance dust and inhaled particulates to the satisfaction of the Mines Department.

Transfer

11. Prior to any transfer of ownership of the proposal or other action which would give rise to a need to change the nominated proponent, the proponent will advise the Minister for Environment so that a new proponent can be nominated.

Appendix 2

Questions raised in submissions and the proponent's responses (labelled A to M)

(a) What problems do the power fluctuations experienced at the existing operations cause. If the problems result in failure of pollution control equipment what can be done to rectify the situation?

Major damage to operating equipment and failure/damage of pollution control equipment have resulted due to the power problems in the past. However operating procedures have now been modified to protect equipment. AMC Mineral Sands Ltd (AMC) would welcome any move to have the gas fired turbines at Mungara feed continuously to Geraldton.

(b) Can the stack gas discharges be continuously monitored as opposed to only regular monitoring?

The company would give strong consideration to installation of continuous gas monitoring equipment, after consultation with the Environmental Protection Authority, should proven equipment be available and be technologically and economically feasible.

(c) What dust control measures are planned at the wharf when the ship is being loaded?

The Geraldton Port Authority and others own the equipment used by AMC for loading the ships. A review of the present loading system, including dust control, is presently being undertaken and AMC has offered its assistance and expertise.

(d) What dust control measures are planned for the transport of products by road or rail?

Transport of the synthetic rutile from Narngulu to the wharf is carried out using totally sealed Westrail wagons specifically designed for the transport of mineral sands.

Material cartage by road is used only as a last resort in the event Westrail cannot meet their commitments. These trucks are sealed similar to the rail wagons used for grain transport.

(e) What guarantee can the company provide that in the event of bankruptcy, the site will be recommissioned and left in an environmentally secure state?

The Renison Goldfields Consolidated Group holding companies and the wholly owned Australian subsidiaries have entered into indemnities, whereby the parent company and each subsidiary have effectively undertaken to guarantee the debts of each other.

This guarantee would extend to rehabilitation obligations.

(f) What is the likely impact of the increased processing capacity in terms of road and rail transport through or near residential areas?

The increased capacity of the operation will in effect reduce the tonnage of material railed through residential areas by substituting synthetic rutile (260,000 tonnes) for the raw feed material (460,000 tonnes). The reduction in weight is a function of the industrial process.

It is not planned to increase road transport as the plant design and feasibility is based on a rail transport system.

(g) Will the proponent include in its monitoring programme a special commitment to conduct intense monitoring at the commissioning stage of the expanded operation?

The proponent has committed to undertake a monitoring programme for exhaust stack emissions with a frequency to be determined in consultation with the Environmental Protection Authority. No change has occurred in this commitment and the company is in agreement to discuss the frequency of the monitoring.

(h) Will the proponent establish a community liaison committee to review public response to the operations and the success of the monitoring programme during the commissioning stage?

The proponent considers that the existing facility for liaison is most appropriate at this time. This includes all monitoring results being forwarded to the Environmental Protection Authority for review and all complaints being recorded in a log for action and made available to the Environmental Protection Authority. The proponent also liaises with the local council and complainants over all reports to ensure the community's interests are protected.

(i) How much carbon dioxide, oxides of nitrogen and methane will be produced by the plant after the expansion. What impact is it likely to have on the greenhouse effect?

Design improvements for the expanded plant includes an efficient heat recovery system and a number of fuel saving techniques that will reduce the total gaseous emissions from the operation.

As all exhaust gases are subject to afterburning and gas scrubbing before emissions to the atmosphere, no methane will be discharged and the expected levels of carbon dioxide and nitrous oxide for the expanded plant are 33 tonnes per hour and 5 kilograms per hour respectively.

The increased fuel usage for the expanded plant will have a minimal impact on the greenhouse effect on a global basis. Expected yearly coal requirements will represent only 1.4 percent of the total annual fuels (expressed as coal equivalents) consumed by the State Energy Commission of WA.

(j) Where do the radioactive elements in the waste end up (including disposal of the filters) and what measures does the proponent take to reduce radiation exposure?

The radioactive element associated with ilmenite, the raw product, is thorium. The process used to produce the synthetic rutile also acts to concentrate

the thorium in the synthetic rutile and consequently result in lower radioactive levels in the waste than the original ilmenite. At no stage does the level of thorium in any product require it to be classified as a radioactive substance.

The proponent commits itself to extending the existing radiation monitoring programme to the satisfaction of the Mines Department.

(k) Why is coal used as an energy source rather than natural gas?

Coal is used not only as an energy source but as a source of carbon in the process. Due to this requirement coal and not gas is used as the primary energy source.

(l) What controls are in place to ensure the safety of employees in respect of the effects of synthetic rutile and radioactive minerals on the lungs of workers?

The possibility of inhaling dust is an acknowledged hazard in the mining industry. AMC ltd has an approved monitoring programme for nuisance dust and inhaled radioactive particles. Results of these programmes are forwarded to the Mines Department and independent sampling is also used by that Department to confirm AMC's results.

The proponent commits itself to extending the monitoring programme for nuisance dust and inhaled particles to the satisfaction of the Mines Department.

(m) Is any solid waste material from the synthetic rutile plant disposed of at a site other than the evaporation ponds or dams?

Dust collector elements representing less than 1 percent of the total site waste materials are the only solids not disposed of in the evaporation ponds or dams. A method of incinerating these elements in the reduction kiln will be prepared to the satisfaction of the Environmental Protection Authority.

The proponent has shown a commitment to the continual improvement of the operating environment by developing procedures and methods that minimise dust generation when handling solid waste material.

Upgrading the iron oxide handling system and introduction of wet disposal for the separation plant solid waste materials are examples of this on-going commitment.

Appendix 3

Public submissions were received from:

City of Geraldton

Shire of Greenough

Department of Mines of Western Australia

Conservation Council of Western Australia.