Wagoo Hills Vanadium Project and Mingenew Coal Project — Project Changes

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Precious Metals Australia Limited

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

The Wagoo Hills Vanadium Project is located approximately 80 kilometres southeast of Mt Magnet and the Mingenew Coal Project is located approximately 20 kilometres northeast of Mingenew.

Precious Metals Australia Limited wishes to amend its approved proposal for the Wagoo Hills Vanadium Project and Mingenew Coal Project by expanding vanadium pentoxide production, modifying processing operations and abandoning the proposed mining of coal at Mingenew.

Section 46 of the *Environmental Protection Act 1986* requires the Environmental Protection Authority (EPA) to report to the Minister for the Environment on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

Relevant Environmental Factors

It is the EPA's opinion that the following environmental factors are relevant to the changed proposal and thus require detailed evaluation in this report:

(a) groundwater quantity – impact on vegetation and other uses;

(b) groundwater quality – waste containment; and

(c) atmospheric emissions - nitrogen oxides and sulphur oxides.

Conclusion

The EPA has considered the above environmental factors and has concluded that the proposed changes to the Wagoo Hills Vanadium Project do not compromise the EPA's current objectives, provided that the amended conditions recommended in Section 4 and set out in Appendix 4, are imposed.

In addition to reporting on the changes to the project, the EPA considers that the conditions of the environmental approval should be updated to clearly indicate the EPA's requirements, and accordingly has also reported on the additional changes required to:

- address the available quantities of groundwater;
- further investigate water conservation measures;
- ensure liquor ponds are properly managed and rehabilitated;
- investigate re-use and disposal of sodium-rich solid waste;
- confirm that the proposed sulphur dioxide and nitrogen oxides impacts are acceptable; and
- clarify and expand the scope of the proponent's Environmental Management Program.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that this report is pursuant to Section 46 of the Environmental Protection Act and thus is limited to consideration of proposed changes to the original proposal;
2. That the Minister considers the report on the relevant environmental factors of groundwater quantity, groundwater quality and atmospheric emissions of nitrogen oxides and sulphur oxides, as set out in Section 3;
3. That the Minister notes that the EPA has concluded that:
    - the changes to the proposal are acceptable, and
    - the Ministerial Conditions of environmental approval should be updated and reflect current practice; and

4. That the Minister imposes the conditions and procedures set out in Appendix 4 of this report.

Conditions

The EPA recommends that the following conditions, which are set out in detail in Appendix 4, be imposed if the proposed changes by Precious Metals Australia Limited for the Wagoo Hills Vanadium Project are approved for implementation:

1. The proponent shall fulfil the commitments in the Consolidated Commitments statement set out as a Schedule to the recommended conditions in Appendix 4; and
2. The existing Ministerial Conditions applied to the project following the recent Section 46 amendment (Environmental Protection Authority 1998), be retained with appropriate modifications to:
    - address the relevant environmental factors considered by the EPA in this report; and
    - expand the scope of the Environmental Management Program to more clearly indicate the need to develop and implement environmental management measures for other issues raised in public submissions as needing attention.

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1. Introduction and background

Precious Metals Australia Limited wishes to make changes to the Wagoo Hills Vanadium Project and Mingenew Coal Project.

The Environmental Protection Authority (EPA) originally assessed this project in 1992 at the level of a Public Environmental Review. The EPA's assessment was reported in Bulletin 633 (Environmental Protection Authority 1992). The Minister for the Environment subsequently gave environmental approval.

Shortly after this, the world vanadium pentoxide price declined and Precious Metals Australia Limited decided not to proceed with the project in accordance with the original schedule.

In 1997, the proponent sought a two year extension of its environmental approval. The EPA recommended the approval period could be extended subject to the recommendations in Bulletin 878 (Environmental Protection Authority 1998) and the proponent's commitments to environmental management.

A review of the feasibility study for the project has recently been completed resulting in a number of modifications to the original proposal.

The modified proposal was referred to the Environmental Protection Authority under Section 46 of the Environmental Protection Act in January 1998. An environmental review document describing the changes was prepared (Alan Tingay & Associates 1998) and was released for public review from 23 February 1998 to 9 March 1998.

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposal. Conditions and procedures to which the proposal should be subject if the Minister determines that it may be implemented are set out in Section 4. Section 5 presents the EPA's conclusion and Section 6 presents the EPA's recommendations.

A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2. Existing draft conditions and proponent commitments for the project are provided in Appendix 3, and recommended conditions and procedures and proponent's commitments are provided in Appendix 4.

The Department of Environmental Protection's (DEP's) summary of submissions and the proponent's responses to those submissions has been published separately and is available in conjunction with this report.

2. The proposal

Approved proposal

The approved proposal consists of an open cut vanadium mine and a processing operation 80 kilometres southeast of Mt Magnet (see Figure 1) and a coal quarry at Mingenew to provide fuel. The ore milling rate was up to 1.5 x 10^6 tonnes per annum (tpa) and production of vanadium pentoxide was 3,700 tpa.

Proposed changes to approved proposal

The proposed input of ore and output of vanadium pentoxide production have been increased to 2.28 x 10^6 tpa and 7,200 tpa respectively.

The coal mine formerly proposed to be developed at Mingenew, has been abandoned. Instead, two fuel options are being considered:

- a combination of coal (imported through Geraldton), diesel and LPG (option 1); or
- natural gas only (option 2).

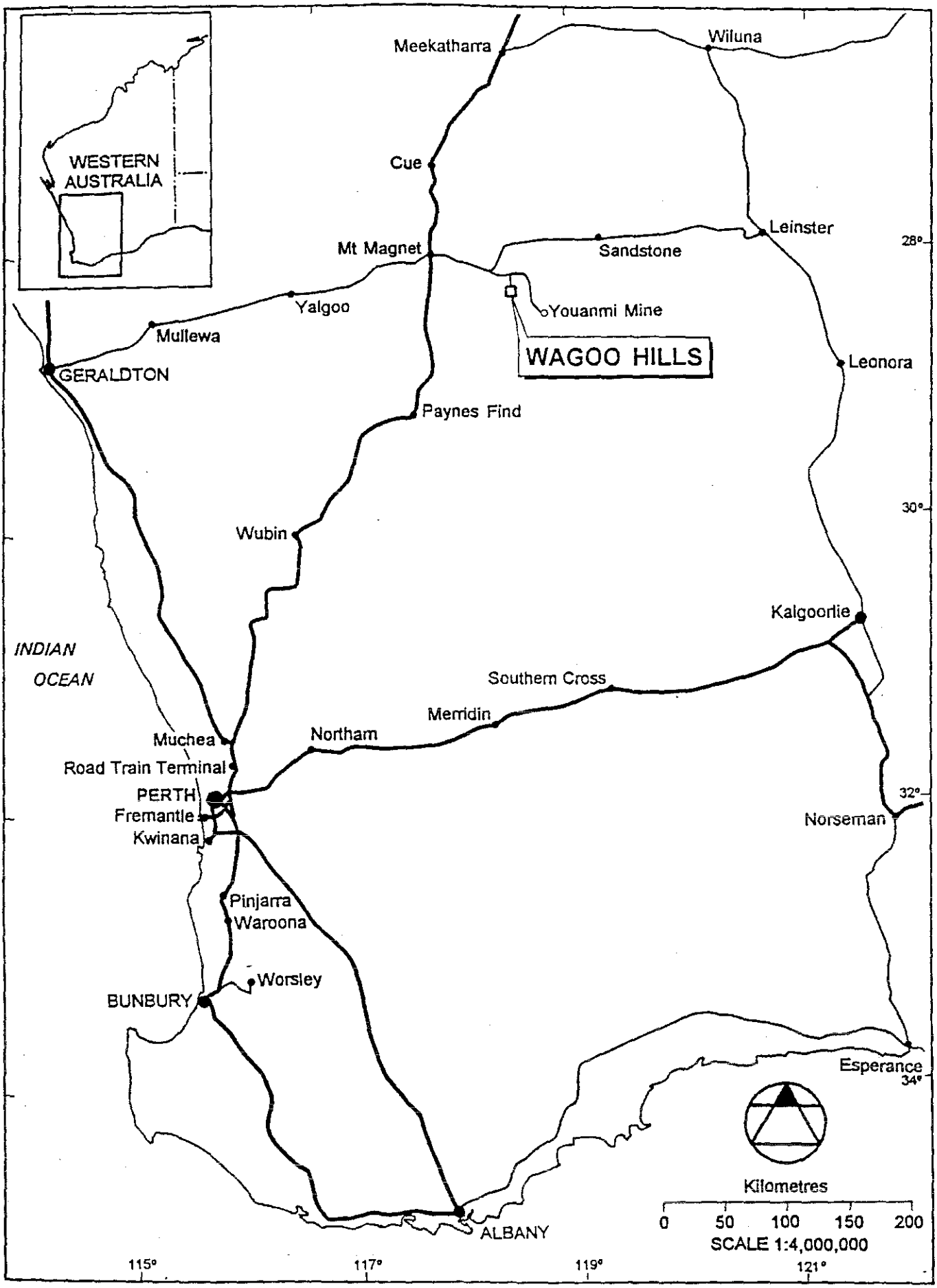

Figure 1. Wagoo Hills Vanadium Project regional location.

Should natural gas be selected as a fuel source, a pipeline would be required. This would be the subject of a separate referral to the EPA.

A summary of the key characteristics of the previous and current proposals is presented in Table 1. Greater usage of some raw materials is also required (Table 2).

Table 1. Summary of key proposal characteristics.

Proposal Characteristics	Units[a]	Previous Proposal	Current Proposal
Ore extraction	tpa	1.5×10^6	2.28×10^6
Production capacity (V_2O_5)	tpa	3,700	7,200
Life of mine production	years	30	> 15
Size of ore body (0.57% average V_2O_5)	tonnes	44×10^6	34×10^6
Area of tenement	ha	988	988
Area of disturbance	ha	Not specified	120
Groundwater requirements	m^3/a	1.1×10^6	2.4×10^6
Atmospheric emissions - Option 1:			
Sulphur oxides	g/s	Not specified	3.58 (power station)
	g/s	20	11.3[b] (rotary kiln)
Nitrogen oxides	g/s	Not specified	31 (power station)
	g/s	Not specified	17.6 (rotary kiln)
Carbon dioxide	tpa	Not specified	124,000 – 148,000
Atmospheric emissions – Option 2:		Not applicable	
Sulphur oxides	g/s		< 1[b] from any source
Nitrogen oxides	g/s		< 1 from any source
Carbon dioxide	tpa		90,000 – 92,000
Tailings (inert)	tpa	$1.3 \times 10^6 - 1.5 \times 10^6$	$1.5 \times 10^6 - 1.7 \times 10^6$
Calcined tailings	tpa	Combined with inert tailings	0.65×10^6
Truck movements	trucks/day	2 - 4	4 – 7[c]

[a] Definitions of units:

"tpa" means tonnes per annum;

"m^3/a" means cubic metres per annum;

"g/s" means grams per second; and

"ha" means hectares (1 ha = 10,000 square metres).

[b] There is some uncertainty regarding this value. In the event that sulphate is recycled back into the process, the emission rate from the rotary kiln is likely to increase.

[c] Calculated from Table 3.7.3 (Alan Tingay & Associates 1998).

Changes are also proposed to the ore processing methods to improve the efficiency of vanadium extraction. These include an additional process step whereby calcined tailings are separated, deposited in a calcined tailings dam (see Figures 2 and 3) and further vanadium is extracted using a heap leach process.

Another possible change may be the greater use of sodium sulphate. A benefit of this could be the ability to recycle sodium in the process thus reducing raw material demands. If, however, significant recycling can not be achieved, additional sodium sulphate in the heap leach areas and the evaporation ponds may increase the risk of groundwater contamination. Greater use of sulphates in the process may lead to increased emissions to the atmosphere in the form of sulphur trioxide or sulphur dioxide.

The process changes and higher throughput increase the demand for groundwater (process water supply) in circumstances where the sustainable yield has yet to be fully confirmed.

Table 2. Raw material quantities for the previous and proposed Wagoo Hills Project.

Raw material	PREVIOUS PROPOSAL[a]		PROPOSED CHANGES[b]	
	Annual requirement	Requirement per tonne of product	Annual requirement	Requirement per tonne of product
Fuel Option 1:				
Coal	30,000 - 70,000 tonnes	8.1 - 18.9 tonnes	30,000 - 45,000 tonnes	4.2 - 6.2 tonnes
Butane or LPG	360 – 550 tonnes	0.10 - 0.15 tonnes	550 - 750 tonnes	0.08 t - 0.10 tonnes
Diesel Fuel	6 - 10 million litres	1622 - 2703 litres	15 - 17 million litres	2080 - 2340 litres
Fuel Option 2:				
Natural Gas	-	-	1,570 – 1,930 terajoules	0.2 - 0.3 terajoules
Sulphuric Acid	4,400 - 6,500 tonnes	1.2 - 1.8 tonnes	3,000 – 4,300 tonnes	0.4 - 0.6 tonnes
Ammonium Sulphate	3,000 - 5,000 tonnes	0.8 - 1.4 tonnes	12,000 - 15,000 tonnes	1.7 - 2.1 tonnes
Aluminium Sulphate as $Al_2O_3 . 3H_2O$	1000 tonnes	0.3 tonnes	0 - 1,000 tonnes	0 - 0.15 tonnes
Sodium Oxalate or Sodium Sulphate	15,000 - 25,000 tonnes	4.0 - 6.7 tonnes	25,000 - 40,000 tonnes	3.5 - 5.6 tonnes
Sodium Hydroxide	0 – 400 tonnes	0 - 0.1 tonnes	0 - 1,000 tonnes	0 - 0.1 tonnes
Flocculant	20 – 40 tonnes	5 - 11 kilograms	20 - 40 tonnes	3 - 6 kilograms

[a] Alan Tingay & Associates (1992)
[b] Alan Tingay & Associates (1998)

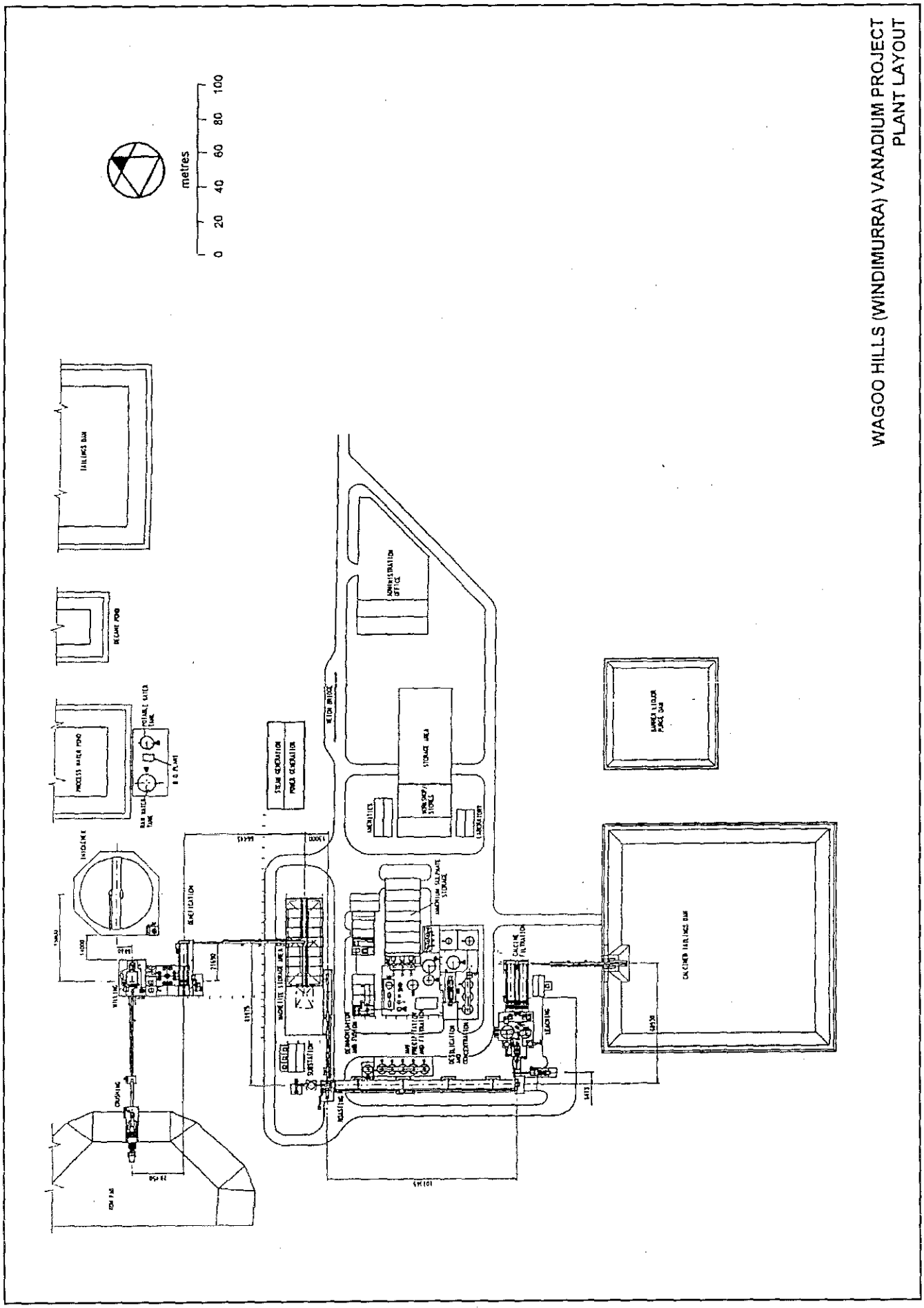

Figure 2. Wagoo Hills Vanadium Project plant layout.

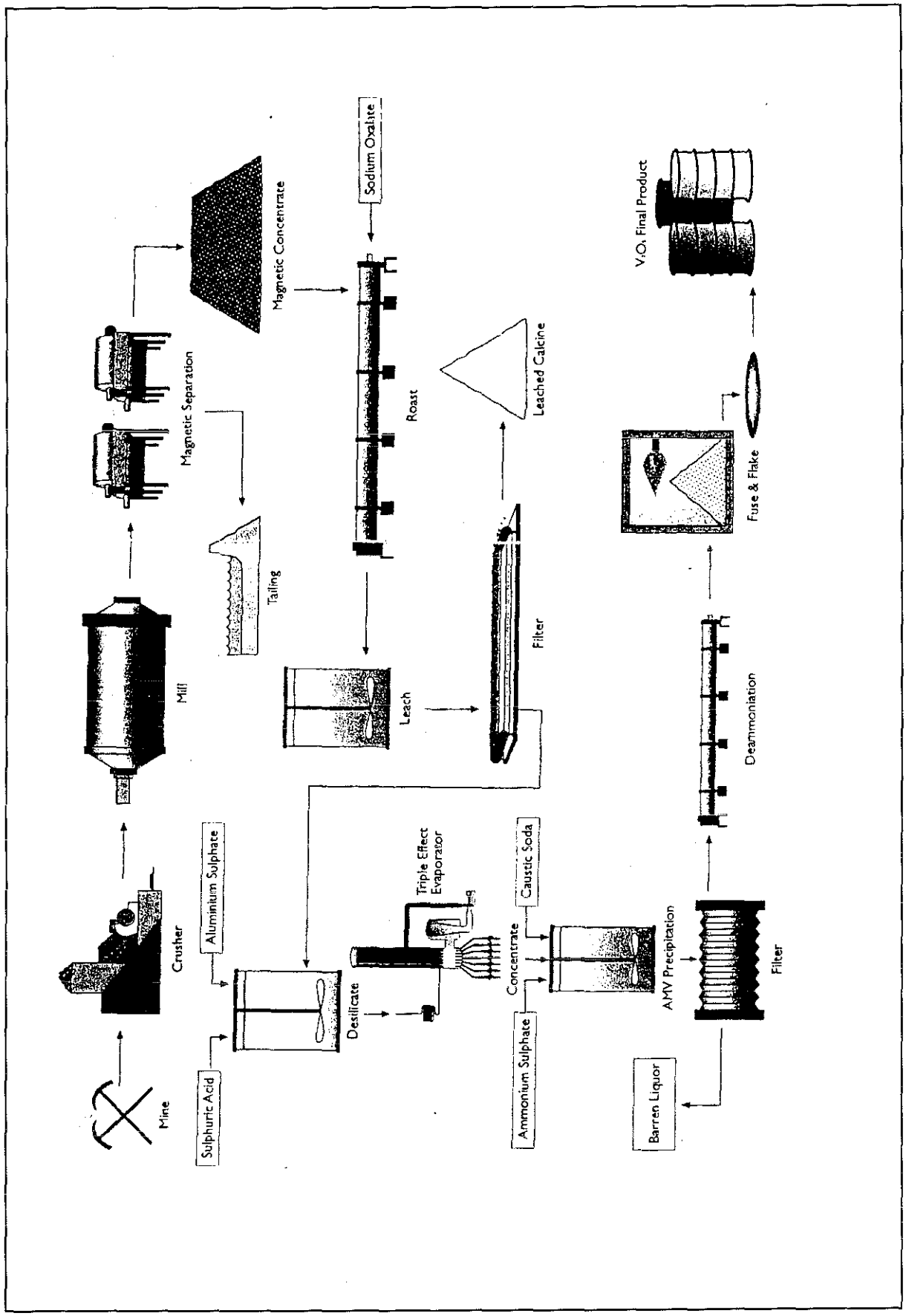

Figure 3. Wagoo Hills Vanadium Project ore processing methodology.

3. Environmental factors

3.1 Relevant environmental factors

Section 46 of the Environmental Protection Act requires the EPA to report to the Minister on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

Following consideration of the review document (Alan Tingay & Associates 1998), public submissions and proponent response to those submissions, the following are considered to be the relevant environmental factors arising from changes to the previous proposal:

(a) groundwater quantity – impact on vegetation and other uses;

(b) groundwater quality – waste containment; and

(c) atmospheric emissions - nitrogen oxides and sulphur oxides.

The identification of relevant environmental factors is summarised in Table 3, and a summary of their assessment set out in Table 4.

The relevant environmental factors are discussed in Sections 3.2 to 3.4 of this report.

This assessment covers changes to the proposal, and their impacts on the environment, only. There are other factors that have been raised in submissions but which are not significantly altered by changes to the proposal and/or are covered by existing environmental conditions and proponent commitments as a result of the earlier assessment. These are:

- vanadium dust;
- non-vanadium particulates/ dust;
- declared rare flora species;
- Aboriginal heritage;
- greenhouse gas emissions; and
- transport of hazardous goods and transport in general.

The factors above are matters that will be addressed in detail through the process of developing an Environmental Management Program, which is a requirement of the current conditions of approval. Accordingly, the existing environmental conditions have been modified to more clearly indicate the need to develop and implement environmental management measures for these factors.

3.2 Groundwater quantity — impact on vegetation and other uses

Description

The level of groundwater extraction under the previously approved proposal was 1.1 x 10^6 cubic metres per annum (m^3/a) (Alan Tingay & Associates 1992). The quantity of groundwater now proposed to be extracted is 2.4 x 10^6 m^3/a. This increased amount of water supply will be drawn from the same borefield, east of the mine and process site, as proposed in 1992. However, the borefield is now proposed to comprise 13 bores, each producing 500m^3/day rather than the five bores producing 600 to 700m^3/day referred to previously.

Groundwater occurs in an upper aquifer at three to eight metres below the surface, and a lower alluvial aquifer at depths between 57 and 76 metres. Plastic clays, between 8 metres and 57 metres thick, occur between these aquifers and are considered to be impermeable (Alan Tingay & Associates 1998).

Geological interpretation of the dimensions of the paleochannel indicated previously that 1.1 x 10^6 m^3/a could be abstracted "with a large margin of safety" (Rockwater Proprietary Limited 1991) from the lower aquifer.

Table 3. Identification of relevant environmental factors (Wagoo Hills Vanadium Project).

ENVIRONMENTAL FACTOR	COMPONENT OF ORIGINAL PROPOSAL	COMPONENT OF CHANGED PROPOSAL WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Biophysical				
Declared rare flora	Clearing for coal and vanadium mines and plantsite.	Coal mine abandoned reducing clearing - now 120 ha. of clearing.	CALM and Wildflower Society: Need survey for Declared Rare Flora	Survey for DRF to be undertaken and appropriate management plan developed as requirement of Environmental Management Program. **Factor does not require further EPA evaluation.**
Groundwater (quantity)	Previous proposed groundwater extraction was 1.1 $x10^6$ m^3/a.	Proposed groundwater extraction is 2.4 $x10^6$ m^3/a from deep aquifer. Sustainable yield estimated to be 3 $x10^6$ m^3/a (Rockwater 1991). Preliminary investigations indicate local drawdown of 5 to 10 metres. Detailed investigation of groundwater supply currently being undertaken.	Shire of Mount Magnet: Expanded water requirements may affect other uses. Local pastoralist: Concern expressed on effect of groundwater extraction on stock use, native birds, plants. WA Museum: effect on stygofauna DEP: effect of drawdown on vegetation	Level of abstraction is close to sustainable yield. More detailed investigations are required. **Considered to be a relevant environmental factor.**
Pollution				
Dust/fumes (vanadium)	Previous proposal had potential for vanadium dust emissions.	Changed proposal does not significantly increase potential for vanadium dust/fume emissions. The nearest residence is more than 4 kilometres away from the processing plant. The next nearest residence 20 kilometres away.		The EPA previously considered that by effectively controlling vanadium dust levels at the mine site and process plant, levels beyond the project area would be minimised. The Department of Minerals and Energy and the works approval and licence issued by the DEP can implement the level of control necessary. Conditions and commitments require

Dust/fumes (vanadium) (cont'd)				monitoring by proponent to verify impacts are acceptable. **Factor does not require further EPA evaluation.**
Particulates/dust	Previous proposal had potential for dust emissions.	Changed proposal does not significantly increase potential for general dust emissions. Requirement for dust control during coal handling at Geraldton.	Local pastoralist: Queried dust control of ore stockpile. DEP: Need for dust control during coal handling at Geraldton.	Potential for dust impacts are similar to those of any remote mining project and can be similarly managed. Conditions and commitments require monitoring by proponent to verify impacts are acceptable. Able to be managed under Part V of the Environmental Protection Act. Coal handling covered by Port Authority's DEP licence. **Factor does not require further EPA evaluation.**
Atmospheric emissions (SO_x, NO_x, CO and ammonia)	Previous proposed fuel source was diesel, LPG and coal from mine to be developed at Mingenew.	The proposed coal mine at Mingenew has been abandoned. Coal is to be imported instead. Natural gas is also considered as a fuel option. If natural gas is the selected fuel source, combustion emissions are negligible. Emissions of NO_x and SO_x from power station and kiln respectively, using diesel and coal as fuels, need stack heights verified to ensure requirements for acceptable off-site impacts are met. Process-related emissions of particulates, acid gases, CO, vanadium are small.	Local pastoralist: Queried likely kiln stack height and fumes.	There appears to be potential for a moderate NO_x emission and significant SO_x emission from calcining kiln. **Atmospheric emissions of NO_x and SO_x emissions considered to be a relevant environmental factor.**
Greenhouse gases	Previous proposal did not consider greenhouse gas emissions.	Greenhouse gas (CO_2) emissions will result from fuel usage. Estimated CO_2 emissions for natural gas or diesel, butane and coal are up to 92,000 tpa and 148,000 tpa. These correspond to 0.02% or 0.03% of Australia's annual greenhouse gas emissions. Total CO_2 emissions over 15 year project life is 1.4 $x10^6$ tonnes or 2.2 $x10^6$ tonnes. Revised process plant is inherently more efficient – illustrated by 95% increase in production achieved with a 57% increase in mining rate.		This issue has been addressed through a previous commitment to implement EPA draft policy and the environmental conditions already imposed on this project (Environmental Protection Authority 1998). **Factor does not require further EPA evaluation.**

Greenhouse gases (cont'd)		Use of natural gas (if selected) will improve greenhouse gas efficiency. Other greenhouse gas emissions are negligible. Changed proposal is potentially more greenhouse gas efficient than previous proposal.		
Groundwater quality	Previous proposal had calcined tailings containing leachable sodium salts combined with magnetite separation tailings and disposed of together in conventional tailings dam.	For changed proposal, calcined tailings are separated and deposited to heap leach pads for recovery of leachable salts. Other potential sources of groundwater contamination include: • barren liquor evaporation ponds; • on-site hydrocarbons and chemicals storage; and • domestic waste landfill. The tailings dam now contains crushed ore only, with no process chemicals added.	Local pastoralist: Concern expressed regarding effects on groundwater quality from chemicals storage and storage dams.	Long term management of on-site solid wastes containing leachable salts needs to be addressed. **Considered to be a relevant environmental factor.**
Social Surroundings				
Aboriginal heritage	Potential for disturbance of archaeological material or sites of significance	Potential for disturbance of archaeological material or sites of significance	Dept Aboriginal Affairs: Require archaeological report to assess significance. Environment Australia: Proponent should liaise with traditional Aboriginals of the area.	Report provided to Dept. Aboriginal Affairs satisfaction. Requirement of Environmental Management Program. **Factor does not require further EPA evaluation.**
Public health and safety (transport of hazardous goods and transport in general)	Previous proposal anticipated two to four truck movements per day.	Changed proposal anticipates about double the number of truck movements.	Shire of Mount Magnet and local pastoralist: Concern expressed regarding effect of heavy vehicles on roads.	Factor previously addressed by EPA (Environmental Protection Authority 1992). Issue needs to be resolved through negotiation between the Main Roads Department, relevant local government authorities and Precious Metals Australia. **Factor does not require further EPA evaluation.**

Table 4. Summary of assessment of relevant environmental factors (Wagoo Hills Vanadium Project).

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Groundwater quantity.	Area surrounding the borefield on Windimurra pastoral station.	Maintain the quantity of groundwater so that existing and potential uses are not affected.	Need to confirm available yield from lower aquifer and consider any future proposal to extract from the surface aquifer in view of potential impact to vegetation and other uses.	Having particular regard to the: (a) groundwater extraction from the lower aquifer being within the sustainable yield of that aquifer; (b) groundwater extraction from the lower aquifer being unlikely to affect groundwater levels in the upper aquifer; (c) proponent's commitments to address adverse impacts on existing groundwater uses and monitor impact on vegetation caused by groundwater extraction; (d) proponent's requirement through an Environmental Management Program to further investigate options for reducing water usage; (e) proponent's requirement through a water management plan to monitor the level of drawdown of the surface and deep aquifers, and address impacts on vegetation and other uses; and (f) requirement for a licence, to abstract groundwater, from the Water and Rivers Commission, it is the EPA's opinion that the project can be managed to meet the EPA's objective.

Groundwater quality.	Plant site and surrounding area on Windimurra pastoral station.	Maintain the quality of groundwater so that existing and potential uses are not affected.	Manage through revised conditions and EMP.	Having particular regard to the: (a) proponent's requirement to obtain a works approval and licence under Part V of the Environmental Protection Act, which will address potential contamination; (b) proponent's commitment to monitor the groundwater for contamination; (c) proponent's commitments to prevent groundwater contamination through appropriate design, operation and rehabilitation of waste retention facilities, (d) requirement for the proponent through the Environmental Management Program and Water Management Plan to address: • the sealing of the barren liquor ponds and heap leach pads to protect groundwater; • the siting of the barren liquor ponds and heap leach pads to avoid adverse effects on surface drainage; • the management of dust on the surface, if required; • the management of the potential for fauna deaths; and • the rehabilitation of the barren liquor ponds and heap leach pads; (e) requirement for the proponent through the Environmental Management Program to secure disposal and rehabilitation, or reuse, of sodium wastes; and (f) design and eventual rehabilitation of waste retention facilities having to meet the requirements of the Department of Minerals and Energy, it is the EPA's opinion that the project can be managed to meet the EPA's objective.
Atmospheric emissions of nitrogen oxides and sulphur oxides.	At and beyond the residence nearest to the project location.	Ensure off-site impacts meet relevant air quality standards/ guidelines, and the requirement of Section 51 of the Environmental Protection Act (all reasonable and practicable measures are taken to minimise discharges).	Manage through revised conditions and EMP.	Having particular regard to the: (a) remoteness of the site; (b) proponent's commitment to undertake dispersion modelling as a component of an Environmental Management Program, to confirm that emissions control measures are adequate to ensure that the EPA objectives for nitrogen oxides and sulphur oxides will be met; and c) proponent's requirement for a works approval issued under Part V of the Environmental Protection Act, it is the EPA's opinion that the project can be managed to meet the EPA's objective.

Groundwater drawdown in the lower aquifer has the potential to deplete water supplies obtained from stock wells and affect native vegetation dependent on the upper aquifer, if the two aquifers are effectively connected. The effect of the drawdown on stock wells will depend on their depth and distance from the borefield, and the rate and volume of water abstracted from the aquifers. Preliminary investigations suggest that drawdown of the deep aquifer below the borefield may be around five to ten metres. Drawdown will decrease with increasing distance from the borefield. The full lateral extent of drawdown has not been determined.

A hydrologist has been commissioned by Precious Metals Australia Limited to conduct further studies to assess the sustainable yield of the borefield aquifer and determine the likely extent of drawdown.

The proponent has committed to the development of a water management plan that demonstrates that the borefield will operate in a sustainable manner. This will be submitted to the EPA prior to commencing construction.

Groundwater extraction also requires a licence from the Water and Rivers Commission.

Assessment

The relevant area for this factor is considered to be the area surrounding the borefield on Windimurra pastoral station.

The EPA's objective for this factor is to maintain the quantity of groundwater so that existing and potential uses, including the maintenance of ecosystems, are protected.

Previous commitments that have been retained by the proponent include:

- guaranteeing continuity of stock water if changes in groundwater levels caused by the project adversely affect pastoral activities; and
- guaranteeing to provide the pastoral lessee with a potable water supply if the project adversely affects his current source of fresh water.

For this assessment, the proponent has also committed to developing a water management plan that demonstrates that the borefield will operate in a sustainable manner and includes ongoing monitoring.

The issue of a groundwater licence to enable groundwater abstraction for the project is partly dependent on the approval of the Water Management Plan (including the results of a hydrogeological investigation) submitted by the proponent to the Water and Rivers Commission.

The Water and Rivers Commission has advised that:

- preliminary reports of the proponent's hydrogeological investigation suggest that the abstraction of 2.4×10^6 m^3/a of groundwater can be sustainably met from the deep aquifer; and
- abstraction from the deep aquifer is unlikely to affect shallow stock and domestic bores.

Investigations undertaken to date suggest that the thick layer of clay separating the surface aquifer from the deeper aquifer acts effectively as an aquiclude. It is proposed that bores will be screened to ensure that water is extracted from the deep aquifer only (70 metres depth). Provided there is very limited connectivity between the upper and lower aquifers, the extraction of water from the deep aquifer is expected to have minimal impact on the surface aquifer and hence no significant effect on vegetation or other uses dependent on the surface aquifer.

The EPA considers that the capacity of the deep aquifer to supply the required amount of water has not yet been technically demonstrated. If the deep aquifer does not have the necessary capacity, the proponent advises that there are likely to be other options for water supply involving obtaining supplies from similar aquifers further from the site. These options would require subsequent assessment against the EPA's objectives. This can be addressed through the groundwater licensing process of the Water and Rivers Commission and an Environmental Management Program supported by an appropriate condition.

The EPA believes that to minimise the potential for adverse impacts on vegetation and other water users, every effort should be made to conserve water and reduce the water demand of the proposal. The EPA considers that the proponent should undertake further investigations into measures for reducing water usage and describe these water conservation measures in an Environmental Management Program. The extent and level of drawdown from the deep aquifer needs to be carefully monitored.

Having particular regard to the:

(a) groundwater extraction from the lower aquifer being within the sustainable yield of that aquifer;

(b) groundwater extraction from the lower aquifer being unlikely to affect groundwater levels in the upper aquifer;

(c) proponent's commitments to address adverse impacts on existing groundwater uses and monitor impact on vegetation caused by groundwater extraction;

(d) proponent's requirement through an Environmental Management Program to further investigate options for reducing water usage;

(e) proponent's requirement through a water management plan to monitor the level of drawdown of the surface and deep aquifers, and address impacts on vegetation and other uses; and

(f) the requirement for a licence, to abstract groundwater, from the Water and Rivers Commission,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objective for groundwater quantity subject to the successful implementation of the proponent's commitments and the EPA's conditions.

3.3 Groundwater quality – waste containment

Description

The previous proposal involved the disposal of calcined tailings, containing leachable sodium salts, into a conventional, unlined, tailings dam also containing magnetite separation tailings.

The current proposal involves the deposition of 650,000 tonnes per annum (tpa) of calcined tailings on HDPE-lined (heavy duty plastic) heap leach pads for the recovery of leachable vanadium.

The current proposal incorporates the possibility of using large quantities (25,000 to 40,000 tpa) of sodium sulphate as a reagent, together with the use of evaporation ponds to recover sodium sulphate for subsequent re-use in the process.

Sampling of stock wells has yielded groundwater salinities of between 1,700 to 8,600 milligrams per litre in the upper aquifer. The range of salinities in the lower alluvial aquifer is reported at 14,000 milligrams per litre.

The upper aquifer, which is within three metres of the surface, is used for stock watering and may support vegetation.

Assessment

The relevant area for this factor is considered to be the plant site and surrounding area on Windimurra pastoral station.

The EPA objective for this factor is to maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance are protected.

Heap leach operations are subject to regulation through DEP works approvals and licences under Part V of the Environmental Protection Act.

Heap leach treatment of calcined tailings offers a potentially significant environmental improvement compared to the previous proposal. This is because the leachable solids which would otherwise have been deposited in a conventional, unlined, tailings dam, will now be separated and retained on impervious heap leach pads.

A major consideration however, is that once the vanadium has been extracted from the calcined residue, the residual solids containing high quantities of leachable sodium salts will need to be carefully managed to prevent contamination of the soil and surface aquifer. Also during heap leaching construction and operations, the integrity of the HDPE liner needs to be assured to prevent contamination of the environment.

Similarly, the evaporation ponds used to recover sodium sulphate for subsequent re-use in the process will also need careful management to prevent contamination.

The EPA considers that a groundwater monitoring program needs to be implemented to assess potential contamination arising from the operation of the mine-site, process plant, heap leach pads, barren liquor evaporation ponds and tailings dam. This is to be addressed in the Environmental Management Program.

There are still uncertainties regarding the ultimate fate of sodium salts used in the process. At this stage, it appears that sodium-rich solid wastes (chemical characteristics not available) could be left on the site, requiring rehabilitation. Although these wastes will be on liners, it is likely to be difficult to prevent the long term leaching of sodium salts from such rehabilitated areas from entering the groundwater.

The proponent is investigating the feasibility of greater recycling of sodium salts which if implemented should reduce raw material requirements and lessen the quantity of sodium-rich solid waste requiring rehabilitation.

The EPA believes that disposal of waste sodium salts should not significantly impact groundwater quality.

Accordingly, the proponent should further investigate options for reuse of the sodium-rich solid waste in the process, and options for secure on-site or off-site disposal. If solid wastes from the barren liquor pond and heap leach are to be left on the site, the method of securing the waste needs to be considered at the design stages of the project and reported in the Environmental Management Program.

The Environmental Management Program should also address the potential for fauna deaths from use of the barren liquor pond, as well as potential dust emissions.

Having particular regard to the:

(a) proponent's requirement to obtain a works approval and licence under Part V of the Environmental Protection Act, which will address potential contamination;

(b) proponent's commitment to monitor the groundwater for contamination;

(c) proponent's commitments to prevent groundwater contamination through appropriate design, operation and rehabilitation of waste retention facilities,

(d) requirement for the proponent through the Environmental Management Program and Water Management Plan to address:

- the sealing of the barren liquor ponds and heap leach pads to protect groundwater;
- the siting of the barren liquor ponds and heap leach pads to avoid adverse effects on surface drainage;
- the management of dust on the surface, if required;
- the management of the potential for fauna deaths; and
- the rehabilitation of the barren liquor ponds and heap leach pads.

(e) requirement for the proponent through the Environmental Management Program to secure disposal and rehabilitation, or reuse, of sodium wastes; and

(f) design and eventual rehabilitation of waste retention facilities having to meet the requirements of the Department of Minerals and Energy,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objective for groundwater quality.

3.4. Atmospheric emissions - nitrogen oxides and sulphur oxides

Description

The air quality ambient limits that the DEP has advised the proponent are relevant to this proposal are shown in Table 5.

Table 5. Ambient air pollutant limits.

Pollutant[a]	Units	Averaging Time	Maximum concentration	Goal: maximum allowable exceedences in a year
Nitrogen dioxide	ppm	1 hour	0.125	1
		1 year	0.03	0
Sulphur dioxide	ppm	1 hour	0.20	1
		1 day	0.08	1
		1 year	0.02	0

[a] Sourced from draft National Environment Protection Measure and Impact Statement for Ambient Air Quality, 21 November 1997 (NEPC 1997).

The highest nitrogen oxides (NOx) emissions are predicted to occur if coal is used to fuel the rotary kiln and the power station is fired on diesel. The predicted emission rates are typical of that for a moderate scale processing plant. The design of appropriate stack heights should be adequate to ensure that the EPA objectives for ambient NOx concentrations can be met. The proponent has committed to undertaking the necessary dispersion modelling and reporting the results in an Environmental Management Program.

Fuel-related sulphur dioxide (SO_2) emissions are predicted to be similar in magnitude to NOx emissions if coal and diesel fuels are used. Similarly, the design of appropriate stack heights to disperse emissions should ensure the EPA objectives for ambient sulphur dioxide concentrations are met.

A change to the proposal involves the possible use of sodium sulphate as a replacement for sodium oxalate, to provide the sodium required for vanadium extraction. If this substitution took place, a much greater amount of sulphur oxides could be generated from the process.

Assessment

The relevant area for this factor is considered to be at and beyond the residence nearest to the proposal.

The EPA objective for this factor is to ensure off-site impacts meet relevant air quality standards/guidelines, and that the requirement of Section 51 of the Environmental Protection Act (all reasonable and practicable measures are taken to minimise discharges) is met.

The possible use of sodium sulphate as a replacement for sodium oxalate increases the load of sulphur compounds to the venturi scrubber serving the rotary kiln. There is some uncertainty regarding the level of SO_2 and sulphur trioxide (SO_3) emissions from the kiln in these circumstances. The key issues are the levels of sulphur oxides that may be evolved from

sulphate salts in the kiln environment, the relative proportions of SO_2 and SO_3 generated, and the consequential efficiency of the venturi scrubber. The venturi scrubber is likely to more effectively remove SO_3 than SO_2 because the former is more water-soluble. These matters require further technical investigations by the proponent. The proponent has committed to clarifying the emissions rates, then undertaking dispersion modelling to confirm that the stack height will be designed to ensure adequate dispersion to achieve the EPA objectives. These results will also be reported in an Environmental Management Program. This factor will also be addressed by the Department of Environmental Protection when an application for a works approval is submitted, as required under Part V of the Environmental Protection Act.

Having particular regard to the:

(a) remoteness of the site;

(b) proponent's commitment to undertake dispersion modelling as a component of an Environmental Management Program, to confirm that emissions control measures are adequate to ensure that the EPA objectives for nitrogen oxides and sulphur oxides will be met; and

(c) proponent's requirement for a works approval issued under Part V of the Environmental Protection Act,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for nitrogen oxides and sulphur oxides.

4. Conditions

Section 46 of the Environmental Protection Act requires the EPA to report to the Minister for the Environment on whether or not the conditions or procedures should be changed. In addition, the EPA may make recommendations as it sees fit.

The environmental conditions currently applicable to the Wagoo Hills Vanadium Project and Mingenew Coal Project are contained in Appendix 3.

The EPA's proposed changes to the existing environmental conditions and proponent commitments are set out in greater detail in Table 6 below. Table 6 should be examined in conjunction with the original environmental conditions in Appendix 3 and the recommended draft conditions in Appendix 4.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal. Following discussion with the proponent, the EPA may seek additional commitments.

The environmental management commitments made by the proponent are included with the recommended conditions.

The EPA recognises that not all of the commitments may be written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for and commitment to continuous improvement in environmental performance. The commitments, modified if necessary to ensure enforceability, then form part of the conditions to which the proposal should be subject if it is to be implemented.

The EPA may, of course, also recommend conditions additional to those relating to the proponent's commitments.

The EPA has taken the opportunity during this assessment to review the environmental conditions set on this proposal with a view to:

(a) facilitating subsequent auditing of the conditions and commitments;

(b) adding further conditions relating to the expansion of the project, including-

- addressing the available quantities of groundwater;

- addressing the potential for adverse effects on groundwater, surface drainage, dust emissions, fauna deaths and rehabilitation from the operation of barren liquor ponds and heap leach facilities;
- further investigating water conservation measures;
- investigating re-use and disposal of sodium-rich solid waste; and
- confirming that the proposed sulphur oxides and nitrogen oxides impacts are acceptable; and

(c) clarifying and expanding the scope of the proponent's Environmental Management Program.

The EPA recommends that the proposed changes to conditions described in Table 6, and set out in detail in Appendix 4, be imposed if the expansion proposed by Precious Metals Australia Limited for the Wagoo Hills Vanadium Project is approved.

5. Conclusions

It is the EPA's opinion that the following environmental factors were relevant to the changed proposal and thus required detailed evaluation in this report:

(a) groundwater quantity – impact on vegetation and other uses;

(b) groundwater quality – waste containment; and

(c) atmospheric emissions - nitrogen oxides and sulphur oxides.

The EPA has considered the above environmental factors and has concluded that the proposed changes to the Wagoo Hills Vanadium Project can be managed in an environmentally acceptable manner, provided that the amended conditions recommended in Section 4 and set out in Appendix 4, are imposed.

In addition to reporting on the changes to the project, the EPA considers that the conditions of the environmental approval should be updated to clearly indicate the EPA's requirements, and accordingly has also reported on the additional changes required to:

- address the available quantities of groundwater;
- further investigate water conservation measures;
- ensure liquor ponds are properly managed and rehabilitated;
- investigate re-use and disposal of sodium-rich solid waste;
- confirm that the proposed sulphur oxides and nitrogen oxides impacts are acceptable; and
- clarify and expand the scope of the proponent's Environmental Management Program.

Table 6. Proposed changes to environmental conditions and commitments.

Original Condition or Commitment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
12	Identification of proponent.	Renumbered.	**1 Proponent** 1-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal. 1-2 Any request for the exercise of that power of the Minister referred to in condition 1-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement. 1-3 The proponent shall notify the Minister for the Environment of any change of proponent contact name and address within 30 days of such change.	

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
13	Commencement requirement.	Renumbered.	**2 Commencement** 2-1 The proponent shall provide evidence to the Minister for the Environment within two years of the date of this statement that the proposal has been substantially commenced. 2-2 Where the proposal has not been substantially commenced within two years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced. 2-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond two years from the date of this statement. 2-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding two years for the substantial commencement of the proposal.	
3	Implementation of commitments.	*Wording changed to recast condition into contemporary format.*	**3 Implementation** 3-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in Schedule 1 of this statement.	
2	Changes to implementation.	Renumbered.	**4 Changes to Implementation** 4-1 Where, in the course of implementing the proposal, the proponent seeks to change any aspect of the proposal as documented in Schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.	

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
1-1, 1-2	Proponent commitment.	Renumbered.	**5 Proponent Commitments** 5-1 The proponent shall implement the consolidated environmental management commitments documented in Schedule 2 of this statement. 5-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.	
3	Requirement for Environmental Management System .	Renumbered.	**6 Environmental Management System** 6-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to the start of mining, the proponent shall prepare Environmental Management System documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection. 6-2 The proponent shall implement the Environmental Management System referred to in condition 6-1.	
4	Environmental Management Program to address environmental issues identified through previous assessment of the vanadium and coal projects:	EMP expanded to include:	**7 Environmental Management Program** 7-1 Prior to commencement of ground-disturbing activities, the proponent shall prepare an Environmental Management Program to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, and the Water and Rivers Commission, as appropriate. The Program shall address:	

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
	stakeholder consultation,	*input from stakeholders,*	1. *stakeholder consultation involved in the development of the program;*	
5.5	reducing water demand, sodium-rich wastes,	*water conservation, and to delete reference to the abandoned Mingenew coal project,* *potential for water contamination,*	2. *options for reducing water demand and to what extent, if any, they will be implemented (See condition 9-2);* 3. *disposal and reuse options for the sodium-rich solid wastes;*	(1) Implement measures in the process plant to conserve water.
8.2 8.1	dispersion modelling of NOx and SOx,	*confirming that NOx and Sox levels are acceptable,*	4 *dispersion modelling to confirm that emissions parameters are adequate to ensure that the Environmental Protection Authority objectives for nitrogen dioxide and sulphur dioxide will be met;*	(2) Submit a detailed composition of the coal to the EPA and Department of Minerals and Energy to assist in designed management plans. (3) Submit final design details of exhaust stacks and exhaust cleaning devices prior to construction for approval by the EPA as part of the Environmental Management Program. *(4) Undertake modelling of principal atmospheric contaminants prior to plant construction.* *(5) Implement atmospheric monitoring program.*
7.1	vanadium and non-vanadium dust,	confirming that vanadium levels are acceptable, *confirming that dust levels are acceptable,*	5 control of vanadium dust *(including evaporation ponds)* and an ambient monitoring program to determine levels at residential premises near the Wagoo Hills *site;* 6 *control of non-vanadium dust (including evaporation ponds) and an ambient monitoring program to determine levels at residential premises near the Wagoo Hills site (see Condition 8);*	(6) Ensure that vanadium dust is controlled to below limits established in the Mines Safety and Inspection Act 1994, by incorporating dust extraction and collection equipment in the process plant.

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
	declared rare and priority flora,	*Vegetation,*	7 *surveys and management of declared rare and priority flora and vegetation;*	*(34) Undertake a vegetation survey over the area affected by the mine and process plant and prepare a vegetation management plan.*
4.1	waste dumps design and rehabilitation,	*progressive stabilisation of disturbed areas,*	8 *a rehabilitation program which includes progressive objectives and monitoring;*	(7) Design and rehabilitate all waste dumps in consultation with the Department of Minerals and Energy and in accordance with the "Guidelines for Waste Dump Design and Rehabilitation" of that Department.
9.1	transport issues,	*transport issues arising from increased raw materials usage,*	9 transportation of process materials,	*(8) Work cooperatively with the Shire of Mount Magnet, other government bodies and other users of the portion of unsealed road affected by the Wagoo Hills Project to ensure that the road is satisfactorily maintained.* (9) Develop a transportation management and contingency plan to ensure that the transportation of hazardous materials is undertaken safely. A driver training program will be incorporated into the plan and will include regular review of driver awareness. Similarly, the integrity of transportation equipment will be monitored on a regular basis. The transportation management and contingency plan will be developed in consultation with the Explosives and Dangerous Goods Division of the Department of Minerals and Energy and the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS).
	contamination, and	*avoiding future contamination issues, and*	*10 monitoring vanadium contamination in soil;*	
	Aboriginal issues.	*Aboriginal issues,*	*11 protection of Aboriginal sites;* *12 the management of the potential for fauna deaths due to the barren liquor ponds;*	*(35) Liaise with the traditional Aboriginals of the region as required.*

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
			13 the ability to rehabilitate the barren liquor pond and heap leach pad residual solid waste; and *14 the potential presence of stygofauna in groundwater,* *and include the following Environmental Plans:* *1 Water Management Plan (See condition 9);* *2 Noise Management And Monitoring Plans (See conditions 10 and 11); and* *3 Greenhouse Gas Emissions Management Plan (See condition 12).* 7-2 The proponent shall implement the Environmental Management Program required by condition 7-1.	
6	Prevent excessive levels of non-vanadium dust.	Renumbered.	**8 Non-vanadium dust levels** The Wagoo Hills Vanadium Project should not cause excessive levels of "non-vanadium dust". 8-1 The proponent shall not cause short term levels of non-vanadium bearing dust at residential premises near the Wagoo Hills Vanadium Project to exceed 1000 micrograms per cubic metre ($\mu g/m^3$), measured continuously over 15 minutes. Note: The 1000 $\mu g/m^3$ limit referred to in condition 8-1 is to be considered a minimum standard to be met by the proposal. It should be understood that the project may be subject to more stringent dust limits set by the Department of Environmental Protection through Works Approval and/or Licence conditions.	*(10) An EMP will be prepared prior to construction commencing which provides detailed design information on dust control systems. These will be prepared to the satisfaction of the EPA on the advice of the Pollution Prevention Division.* *(11) All process areas are sealed with impermeable floors and bunded to permit ready clean-up of spillages, which are potential dust sources.* *(12) The calcined tailings dump is continuously wetted to prevent wind blown dust.* *(13) PMA will develop a Spill Management Plan which requires immediate clean-up of spills with any contaminated materials or soils being recycled through the process.*

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
1.1[d]	Minimise vegetation clearing.	Renumbered.		(14) Minimise clearing of land consistent with safe and efficient operations.
2.1[d]	Prevent spread of saffron thistle.	Renumbered.		(15) Develop a management strategy to minimise the spread of saffron thistle. This strategy will be developed in consultation with Agriculture WA.
3.1[d]	Fire control.	Renumbered.		(16) Maintain strict fire control procedures.
9.3[d]	Maintain safety while handling dangerous goods.	Renumbered.		(17) Ensure that all handling, packaging and road transport of inputs to the process plant and products from that plant comply with the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail and the Dangerous Goods Regulations 1992.

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
10.1[d] 10.2[d] 7.2[d]	Ensure workforce are aware of and follow good environmental practices and procedures.	Renumbered. *Commitment to health and safety plan.*		(18) Prohibit domestic pets in the project area as a condition of employment. (19) Restrict off-road driving and prohibit hunting by employees as a condition of employment. (20) Develop an effective operator training and awareness program to ensure that the process plant is well operated and any potential occupational health problems are quickly identified and are rectified immediately. (21) *In order to protect the health of employees a comprehensive health and safety plan[d] will be developed for the site which will address the following issues:* • *Frequent occupational monitoring of airborne vanadium levels within works areas.* • *Regular personal air sampling of employees working in areas with potential exposure to vanadium.* • *Regular health assessment and urine tests for employees.* • *Provision of, and training in the correct use of personal protective equipment.* • *A comprehensive training program in the hazards associated with vanadium for all employees.* • *Strict segregation of mess and meal break areas from process areas with clear procedures to ensure that contaminated protective clothing cannot enter mess areas.*
5	Requirement to manage quantity and quality of ground and surface water resources.	Renumbered. *Water extraction from surface aquifer needs referral to EPA.*	**9 Water Resources** *9-1 Prior to any proposed significant use of the surface aquifer, the proponent shall refer such proposal to the Environmental Protection Authority.*	

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][c]	New condition[c]	New commitment[c]
			9-2 Prior to construction, the proponent shall prepare a Water Management Plan for the Wagoo Hills site for the protection of surface and ground water resources, to the requirements of the Environmental Protection Authority on advice of the Water and Rivers Commission, Agriculture Western Australia, the Department of Minerals and Energy and the Department of Environmental Protection. This plan shall:	
		Address impacts of groundwater extraction.	*1 address the impacts of the proposed extraction on existing uses and vegetation;*	*(22) The proponent will prior to commencing construction develop a water management plan to the satisfaction of the EPA on advice from the Water and Rivers Commission which demonstrates that the borefield will operate in a sustainable manner.*
5-2, 5-3		*Respond to impacts from groundwater extraction.*	2 *notwithstanding the above, describe how suitable water supplies for any stock and domestic water supplies that are adversely affected by the project will be provided and how impacts on vegetation will be minimised;*	(23) Undertake to guarantee continuity of stock water if changes in groundwater levels, caused by the Project, adversely affect pastoral activities. (24) Guarantee to provide the Pastoral Lessee with a potable water supply if the project adversely affects his current source of fresh water.
6.1		Renumbered.	3 address surface water flows affected by the project, *ensuring that surface drainage is not adversely affected by the barren liquor ponds and heap leach pads;*	(25) Prepare drainage management plans for the vanadium mine and process plant at Windimurra in consultation with the Department of Minerals and Energy.

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
5.4 9.2 5.1		*Monitor for potential groundwater contamination and groundwater drawdown.*	*4 outline a groundwater monitoring program to determine:* • *whether there has been any contamination arising from the operation of the mine-site, process plant, heap leach pads, barren liquor evaporation ponds and tailings dam, and* • *the level of drawdown in the upper and lower aquifers;* *5 address options for reducing water demand and to what extent, if any, they will be implemented;* *6 address the method of sealing the barren liquor ponds and heap leach pads to ensure the protection of groundwater; and* 7 specify responsibility for monitoring, auditing of performance and compliance with the plans.	*(26)* Design the tailings dams in consultation with the Department of Minerals and Energy and in accordance with the "Guidelines on the Safe Design and Operating Standards for Tailings Storages" of that Department. *(27) The proponent will manage calcined tailings by utilising a lined tailings dump fitted with a drainage extraction for the return of leachate to the process.* *(28) Storage of hazardous materials will be undertaken in consultation with the Department of Minerals and Energy Explosives and Dangerous Goods Division..* (29) Submit a final design of the storage facility for the sodium salt reagent at Windimurra to the Department of Minerals and Energy and the EPA for approval as part of the Environmental Management Program prior to the construction of the process plant. (30) Design and implement a monitoring program of groundwater levels and water quality in the borefield and other bores in the vicinity of the project area at Windimurra before operational start and to the satisfaction of the Water and Rivers Commission.

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
			9-3 The proponent shall implement the Water Management Plan required by condition 9-2. 9-4 The proponent shall make the Water Management Plan required by condition 9-2 publicly available, to the requirements of the Environmental Protection Authority.	
8	Prevent excessive noise levels and conduct noise monitoring.	Renumbered.	**10 Noise** 10-1 The proponent shall conduct operations so that noise emissions do not unreasonably impact on people in the vicinity of the Wagoo Hills site, including residents. 10-2 The proponent shall ensure that noise emissions meet the requirements of the noise control regulations applying from time to time under the Environmental Protection Act. *10-3 Prior to construction, the proponent shall prepare a Noise Management Plan, to include noise surveys (including baseline measurements) and assessments (including the impact of tonal noise) involving consultation with the Department of Environmental Protection, for the Wagoo Hills site, to the requirements of the Environmental Protection Authority.* *10-4 The proponent shall implement the Noise Management Plan for the Wagoo Hills site required by condition 10-3.* *10-5 The proponent shall make the Noise Management Plan required by condition 10-3 publicly available, to the requirements of the Environmental Protection Authority.*	

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][c]	New condition[c]	New commitment[c]
9	Prevent excessive air pressure levels from blasting.	Renumbered.	**11 Blasting** 11-1 The proponent shall conduct operations so that blasting does not unreasonably impact on people in the vicinity of the Wagoo Hills site, including residents. 11-2 The proponent shall ensure that blasting operations meet the requirements of the noise control regulations applying from time to time under the Environmental Protection Act. *11-3 Prior to construction, the proponent shall prepare a Blasting Management Plan for the Wagoo Hills site to the requirements of the Environmental Protection Authority.* *11-4 The proponent shall implement the Blasting Management Plan for the Wagoo Hills site required by condition 11-3.* *11-5 The proponent shall make the Blasting Management Plan required by condition 11-3 publicly available, to the requirements of the Environmental Protection Authority.*	

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
7	Requirement to develop and implement greenhouse management plan.	Renumbered.	**1 2 Greenhouse** Goning, the proponent shall prepare a Greenhouse **Emissions Management Plan** 12-1 Prior to commissise Gas Emissions Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection. This Plan shall include: 1 calculation of the "greenhouse gas" emissions (using methodology developed for Australia); 2 measures to limit "greenhouse gas" emissions; and 3 estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product. 12-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 12-1. *12-3 The proponent shall make the Greenhouse Gas Emissions Management Plan required by condition 12-1 publicly available, to the requirements of the Environmental Protection Authority.* Note: The proponent should consider entry (whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate) into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement program. Components of the agreement program include: 1 an inventory of emissions; 2 opportunities for abating "greenhouse gas" emissions in the organisation; 3 a "greenhouse gas" mitigation action plan; 4 regular monitoring and reporting of performance; and 5 independent performance verification.	*(31) Prepare a Greenhouse Gas management plan.*

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][c]	New condition[c]	New commitment[c]
14	Requirement for compliance auditing.	Renumbered.	**13 Compliance Auditing** 13-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection. 13-2 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions. 13-3 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.	
10, 4.2, 4.3	Requirement for decommission-ing plan.	Renumbered.	**14 Decommissioning Management Plan** 14-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection. This Plan shall address: 1. removal or, if appropriate, disposal on-site of plant and infrastructure; 2. rehabilitation of all disturbed areas to agreed final land uses; and 3. identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities. 14-2 The proponent shall implement the Decommissioning Management Plan required by condition 14-1. 14-3 The proponent shall make the Decommissioning Management Plan required by condition 14-1 publicly available, to the requirements of the Environmental Protection Authority.	(32) Rehabilitate the surrounds of the vanadium mine site and the process plant and village areas at the Windimurra following decommissioning of the project. (33) Prepare specific proposals for site decommissioning in the event of termination of the project and implement those proposals after review and approval of the relevant Government Agencies at the time.

Original Condition or Commit-ment No[a]	Requirements (summarised)	Evaluation[b][e]	New condition[c]	New commitment[c]
11	Requirement for ongoing performance reviews.	Renumbered.	**15 Performance Review** 15-1 Each six years following the commencement of construction, the proponent shall prepare and submit a performance review to evaluate the environmental performance relevant to: 1 environmental issues reported on in Environmental Protection Authority Bulletins 633, 878 and 887; 2 proponent's consolidated environmental management commitments documented in Schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement; 3 Environmental Management System environmental management targets; 4 Environmental Management Programs and Plans; and 5 environmental performance indicators, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection. Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review. Note: The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.	

Notes (a) A previous condition is indicated by a number (eg 8) or a dashed number (eg 1-1). A previous commitment is indicated by a decimal number (eg 5.1).
(b) "Renumbered" means that the condition and/or commitment wording has not changed but the numbering has changed to consolidate environmental factors togethe
(c) Conditions and commitments in italics are proposed new additions.
(d) It is recommended that this issue is also addressed in the Environmental Management Program.
(e) The previous commitments 1.1(p4) to 7.1(p5) relating to the Mingenew Coal Project have been deleted since this project has been abandoned by the proponent.

6. Recommendations

Section 46 of the Environmental Protection Act requires the EPA to report to the Minister for the Environment on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that this report is pursuant to Section 46 of the Environmental Protection Act and thus is limited to consideration of proposed changes to the original proposal;

2. That the Minister considers the report on the relevant environmental factors of groundwater quantity, groundwater quality and atmospheric emissions of nitrogen oxides and sulphur oxides, as set out in Section 3;

3. That the Minister notes that the EPA has concluded that:

    - the changes to the proposal are acceptable, and

    - the Ministerial Conditions of environmental approval should be updated and reflect current practice; and

4. That the Minister imposes the conditions and procedures set out in Appendix 4 of this report.

Appendix 1

List of submitters

List of organisations and individuals who made submissions

Organisations:

Aboriginal Affairs Department

Conservation Council of Western Australia

Department of Conservation and Land Management

Department of Minerals and Energy

Environment Australia

Shire of Mount Magnet

Water and Rivers Commission

Western Australian Museum

Wildflower Society of Western Australia (Inc.)

Individual:

Mr Dale M. Zadow

Appendix 2

References

Alan Tingay & Associates. 1992. *Precious Metals Australia Limited Wagoo Hills Vanadium Project and Mingenew Coal Project Public Environmental Review*. January 1992.

Alan Tingay & Associates. 1998. *Precious Metals Australia The Wagoo Hills (Windamurra) Vanadium Project, Application for Amendment to Environmental Approval, Section 46 of the Environmental Protection Act 1986*. February 1998.

Department of Environmental Protection. 1997. *Environmental Protection (Noise) Regulations 1997 – Summary of the Regulations*. 31 October 1997.

Department of Minerals and Energy. 1996. *Guidelines on the Safe Design and Operating Standards for Tailings Storage*. March 1996.

Environmental Protection Authority. 1992. *Wagoo Hills Vanadium Project and Mingenew Coal Project: Report and recommendations of the Environmental Protection Authority*. Bulletin 633. Environmental Protection Authority, Western Australia.

Environmental Protection Authority. 1998. *Wagoo Hills Vanadium Project and Mingenew Coal Project – Extension of Time Limit of Approval via Section 46: Report and recommendations of the Environmental Protection Authority*. Bulletin 878. Environmental Protection Authority, Western Australia.

Greenhouse Challenge Office, Canberra. 1996. *The Greenhouse Challenge*.

National Environment Protection Council. 1997. *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 21 November 1997.

Rockwater Proprietary Limited. 1991. *Water Supplies - Precious Metals Australia Pty Ltd Windimurra P.E.R.* October 1991.

Standards Australia. 1997. *AS/NZS ISO 14001:1997 Environmental management systems – Specification with guidance for use*.

Standards Australia. 1997. *AS/NZS ISO 14004:1997 Environmental management systems – General guidelines on principles, systems and supporting techniques*.

Appendix 3

Statement of conditions of approval from previous assessment and previous proponent commitments

MINISTER FOR THE ENVIRONMENT;
EMPLOYMENT AND TRAINING

Statement No.

000472

STATEMENT TO AMEND CONDITIONS APPLYING TO A PROPOSAL (PURSUANT TO THE PROVISIONS OF SECTION 46 OF THE ENVIRONMENTAL PROTECTION ACT 1986)

Title: WAGOO HILLS VANADIUM PROJECT AND MINGENEW COAL PROJECT

Proposal: The development of a vanadium mining and processing operation 80 km south-east of Mt Magnet, and a coal mine near Mingenew to provide a source of energy to the vanadium operation.

Proponent: Precious Metals Australia Limited

Proponent Address: Level 3, 18 Richardson Street , WEST PERTH WA 6005

Assessment Number: 1146

Previous Assessment Number: 653

Previous Statement Number: Statement No. 283 published on 17 September 1992

Report of the Environmental Protection Authority: Bulletin 878

Previous Report of the Environmental Protection Authority: Bulletin 633

The implementation of the proposal to which the above reports of the Environmental Protection Authority relate is now subject to the following conditions and procedures which replace all previous conditions and procedures:

1 Proponent Commitments

1-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 1 of this statement, provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

In the event of any inconsistency, the conditions and procedures shall prevail to the extent of the inconsistency.

1-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

Published on

- 2 APR 1998

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2 Implementation

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

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

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

3 Environmental Management System

3-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to the start of mining at either Windimurra (Wagoo Hills) and/or Mingenew, the proponent shall prepare Environmental Management System documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

3-2 The proponent shall implement the Environmental Management System referred to in condition 3-1.

4 Environmental Management Plans

4-1 Prior to commencement of ground-disturbing activities, the proponent shall prepare Environmental Management Plans to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, and the Water and Rivers Commission.

These Plans shall address:

<u>Vanadium mine (at Windimurra)</u>

1 control of vanadium dust;
2 effect of the proposal on natural drainage;
3 control of noise generated within the mine and plant area;
4 impact of the process water supply borefield (refer to condition 5); and
5 transportation of process materials;

<u>Coal mine (at Mingenew)</u>

6 rehabilitation of the open-cut pit;
7 effect of mining on the groundwater;
8 effects of blasting on neighbouring properties; and
9 control of dust and noise from the crushing plant.

4-2 The proponent shall implement the Environmental Management Plans required by condition 4-1.

4-3 The proponent shall make the Environmental Management Plans required by condition 4-1 publicly available, to the requirements of the Environmental Protection Authority.

5 Water Resources

Development and operation of the Wagoo Hills Vanadium Project should not adversely affect surface and ground water resources on Windimurra Station. If such resources are adversely affected, stock and domestic water supplies of appropriate quality and quantity are to be supplied to Windimurra Station.

5-1 Prior to construction at the Wagoo Hills site, the proponent shall prepare Water Management Plans (referred to in commitments 5.1 to 5.4 and 6.1) for the Wagoo Hills Vanadium Project, to the requirements of the Environmental Protection Authority on advice of the Water and Rivers Commission, Agriculture Western Australia, and the Department of Minerals and Energy.

These Plans shall:

1 address surface water flows affected by the project;

2 outline a groundwater monitoring programme to determine whether there has been any contamination arising from the operation of the minesite or process plant and associated tailings dam;

3 make provision for suitable water supplies for stock and domestic purposes on Windimurra Station if existing supplies are adversely affected by the project; and

4 specify responsibility for monitoring, auditing of performance and compliance with the Plans.

5-2 The proponent shall implement the Water Management Plans required by condition 5-1.

5-3 The proponent shall make the Water Management Plans required by condition 5-1 publicly available, to the requirements of the Environmental Protection Authority.

6 Non-Vanadium Dust Levels

The Wagoo Hills Vanadium Project and the Mingenew Coal Project should not cause excessive levels of "non-vanadium dust".

6-1 The proponent shall not cause short term levels of non-vanadium bearing dust at residential premises near the Wagoo Hills Vanadium Project to exceed 1000 micrograms per cubic metre (ug/m^3), measured continuously over 15 minutes.

6-2 The proponent shall not cause short term levels of non-vanadium bearing dust at residential premises near the Mingenew Coal Project to exceed 1000 micrograms per cubic metre (ug/m^3), measured continuously over 15 minutes.

Note: The 1000 ug/m^3 limit referred to in conditions 6-1 and 6-2 is to be considered a minimum standard to be met by the proposal. It should be understood that the project may be subject to more stringent dust limits set by the Department of Environmental Protection through Works Approvals and/or Licence conditions.

7 Greenhouse Gas Emissions

7-1 Prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall include:

1 calculation of the "greenhouse gas" emissions (using methodology developed for Australia);

2 measures to limit "greenhouse gas" emissions; and

3 estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product.

7-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 7-1.

7-3 The proponent shall make the Greenhouse Gas Emissions Management Plan required by condition 7-1 publicly available, to the requirements of the Environmental Protection Authority.

Note: The proponent should consider entry (whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate) into the Commonwealth Government's "Greenhouse Challenge" voluntary co-operative agreement program.

Components of the agreement program include:

1 an inventory of emissions;

2 opportunities for abating "greenhouse gas" emissions in the organisation;

3 a "greenhouse gas" mitigation action plan;

4 regular monitoring and reporting of performance; and

5 independent performance verification.

8 Noise Limits

The proponent should conduct operations so that noise emissions do not unreasonably impact on people in the vicinity of the Wagoo Hills Vanadium Project and the Mingenew Coal Project.

8-1 The proponent shall ensure that noise emissions meet the requirements of the noise control regulations applying from time to time under the Environmental Protection Act.

8-2 The proponent shall conduct noise surveys (including baseline measurements) and assessments (including the impact of tonal noise) at the Wagoo Hills site and the Mingenew site in consultation with the Department of Environmental Protection.

9 Blast Limits

The proponent should conduct operations so that blasting does not unreasonably impact on people in the vicinity of the Wagoo Hills Vanadium Project and the Mingenew Coal Project.

9-1 The proponent shall ensure that blasting operations meet the requirements of the noise control regulations applying from time to time under the Environmental Protection Act.

10 Decommissioning

10-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall address:

1 removal or, if appropriate, disposal on-site of plant and infrastructure;

2 rehabilitation of all disturbed areas to agreed final land use(s); and

3 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

10-2 The proponent shall implement the Decommissioning Management Plan required by condition 10-1.

10-3 The proponent shall make the Decommissioning Management Plan required by condition 10-1 publicly available, to the requirements of the Environmental Protection Authority.

11 Performance Review

11-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to evaluate the environmental performance relevant to:

1 environmental objectives reported on in Environmental Protection Authority Bulletins 633 and 878;

2 proponent's consolidated environmental management commitments documented in schedule 1 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 Environmental Management System environmental management targets;

4 Environmental Management Plans; and

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.

12 Proponent

12-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

12-2 Any request for the exercise of that power of the Minister referred to in condition 12-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the

proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

12-3 The proponent shall notify the Minister for the Environment of any change of proponent contact name and address within 30 days of such change.

13 Commencement

13-1 The proponent shall provide evidence to the Minister for the Environment within two years of the date of this statement that the proposal has been substantially commenced.

13-2 Where the proposal has not been substantially commenced within two years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

13-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond two years from the date of this statement.

13-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding two years for the substantial commencement of the proposal.

14 Compliance Auditing

14-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

14-2 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

14-3 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

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

CHERYL EDWARDES (Mrs) MLA
MINISTER FOR THE ENVIRONMENT

31 MAR 1998

Schedule 1

Proponent's Consolidated Environmental Management Commitments

April 1992

WAGOO HILLS VANADIUM PROJECT & MINGENEW COAL PROJECT (653/1146)

Precious Metals Australia Limited

The Proponent undertakes to fulfil the following commitments in accordance with the applicable State laws and regulations and with the standards and procedures agreed with the State.

1. Vegetation Clearing

1.1 Minimise clearing of land consistent with safe and efficient operations.

2. Weeds

2.1 Develop a management strategy to minimise the spread of Saffron Thistle. This strategy will be developed in consultation with the Department of Agriculture.

3. Fire

3.1 Maintain strict fire control procedures.

4. Rehabilitation

4.1 Design and rehabilitate all waste dumps in consultation with the Department of Mines and in accordance with the "Guidelines for Waste Dump Design and Rehabilitation" of that Department.

4.2 Rehabilitate the surrounds of the vanadium mine site and the process plant and village areas at Windimurra following decommissioning of the project.

4.3 Prepare specific proposals for site decommissioning in the event of termination of the project and implement those proposals after review and approval of the relevant Government Agencies at the time.

5. Groundwater

5.1 Design and implement a monitoring programme of groundwater levels and water quality in the borefield and other bores in the vicinity of the project area at Windimurra before operational start and to the satisfaction of the Water Authority of WA.

5.2 Undertake to guarantee continuity of stock water if changes in groundwater levels, caused by the Project, adversely affect pastoral activities.

5.3 Guarantee to provide the Pastoral Lessee with a potable water supply if the project adversely affects his current source of fresh water.

5.4 Design the tailings dams in consultation with the Department of Mines and in accordance with the "Guidelines for the Preparation of the New Tailings Dams" of that Department.

5.5 Implement measures in the process plant to conserve water.

6. Surface Water

6.1 Prepare drainage management plans for the vanadium mine and process plant at Windimurra in consultation with the Department of Mines.

7. Dust

7.1 Ensure that vanadium dust is controlled to below limits established in the Mines Regulations Act 1946 and Regulations, by incorporating dust extraction and collection equipment in the process plant.

7.2 Develop an effective operator training and awareness program to ensure that the process plant is well operated and any potential occupational health problems are quickly identified and are rectified immediately.

8. Emissions

8.1 Submit final design details of exhaust stacks and exhaust cleaning devices prior to construction for approval by the EPA as part of the Environmental Management Programme.

8.2 Submit a detailed composition of the coal to the EPA and Department of Mines to assist in designed management plans.

9. Transport/Packaging/Storage

9.1 Develop a transportation management and contingency plan to ensure that the transportation of hazardous materials is undertaken safely. A driver training program will be incorporated into the plan and will include regular review of driver awareness. Similarly, the integrity of transportation equipment will be monitored on a regular basis.

The transportation management and contingency plan will be developed in consultation with the Explosives and Dangerous Goods Division of the Department of Mines and the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS).

9.2 Submit a final design of the storage facility for the sodium salt reagent at Windimurra to the Department of Mines and the EPA for approval as part of the Environmental Management Program prior to the construction of the process plant.

9.3 Ensure that all handling, packaging and road transport of inputs to the process plant and products from that plant comply with the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail and the Dangerous Goods (Road Transport) Regulations 1983 and amended Regulations 1988.

10. Workforce

10.1 Prohibit domestic pets in the project area as a condition of employment.

10.2 Restrict off-road driving and prohibit hunting by employees as a condition of employment.

The Proponent undertakes to fulfil the following commitments in accordance with the applicable State laws and regulations and with the standards and procedures agreed with the State.

1. Weeds

1.1 Develop a management strategy to minimise the spread of Saffron Thistle. This strategy will be developed in consultation with the Department of Agriculture.

2. Rehabilitation

2.1 Backfill the coal quarry with overburden material, replace topsoil, and restore the site to its current use for grain production or natural vegetation.

3. Land Use

3.1 Manage surplus farm land areas in accordance with competent farm management techniques.

4. Groundwater

4.1 Design and implement a monitoring programme for abnormal contaminated coal mine water seeping from the pit and holding pond.

5. Surface Water

5.1 Prepare drainage management plans for the coal quarry at Mingenew in consultation with the Department of Mines.

6. Noise

6.1 Liaise with residents living in the vicinity of the coal quarry to ensure that blasting operations there do not cause a disturbance and modify those blasting operations if necessary.

7. Dust

7.1 Control coal dust and total dust and noise levels in the project areas in accordance with the applicable acts and regulations.

Appendix 4

List of recommended Ministerial Conditions and proponent's consolidated commitments for current proposal

Statement No.

STATEMENT TO AMEND CONDITIONS APPLYING TO A PROPOSAL (PURSUANT TO THE PROVISIONS OF SECTION 46 OF THE ENVIRONMENTAL PROTECTION ACT 1986)

Title: WAGOO HILLS VANADIUM PROJECT AND MINGENEW COAL PROJECT

Proposal: The development of a vanadium mining and processing operation 80 kilometres south-east of Mt Magnet (as documented in schedule 1 of this statement), and a coal mine near Mingenew to provide a source of energy to the vanadium operation.

Proponent: Precious Metals Australia Limited

Proponent Address: Level 3, 18 Richardson Street, WEST PERTH WA 6005

Assessment Number: 1184

Previous Assessment Numbers: 653 and 1146

Previous Statement Numbers: Statement No. 283 published on 17 September 1992, and Statement No. 472 published on 2 April 1998.

Report of the Environmental Protection Authority: Bulletin 887

Previous Reports of the Environmental Protection Authority: Bulletins 633 and 878

The implementation of the proposal to which the above reports of the Environmental Protection Authority relate is now subject to the following conditions and procedures which replace all previous conditions and procedures:

Note: There are now no conditions or procedures referring to the coal mine near Mingenew. The latter part of the proposal may not be implemented.

1 Proponent

1-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

1-2 Any request for the exercise of that power of the Minister referred to in condition 1-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

1-3 The proponent shall notify the Minister for the Environment of any change of proponent contact name and address within 30 days of such change.

2 Commencement

2-1 The proponent shall provide evidence to the Minister for the Environment within two years of the date of this statement that the proposal has been substantially commenced.

2-2 Where the proposal has not been substantially commenced within two years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

2-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond two years from the date of this statement.

2-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding two years for the substantial commencement of the proposal.

3 Implementation

3-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in Schedule 1 of this statement. Note: If Option 2 (natural gas) referred to in Schedule 1 is selected, then the pipeline route should be referred to the Environmental Protection Authority.

4 Changes to Implementation

4-1 Where, in the course of implementing the proposal, the proponent seeks to change any aspect of the proposal as documented in Schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

5 Proponent Commitments

5-1 The proponent shall implement the consolidated environmental management commitments documented in Schedule 2 of this statement.

5-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

6 Environmental Management System

6-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to the start of mining, the proponent shall prepare Environmental Management System documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

6-2 The proponent shall implement the Environmental Management System referred to in condition 6-1.

7 Environmental Management Program

7-1 Prior to commencement of ground-disturbing activities, the proponent shall prepare an Environmental Management Program to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy and the Water and Rivers Commission, as appropriate.

This Program shall address:

1 stakeholder consultation involved in the development of the program;
2 options for reducing water demand and to what extent, if any, they will be implemented (See condition 9-2);
3 disposal and reuse options for the sodium-rich solid wastes;
4 dispersion modelling to confirm that emissions parameters are adequate to ensure that the Environmental Protection Authority objectives for nitrogen dioxide and sulphur dioxide will be met;
5 control of vanadium dust (including the evaporation ponds) and an ambient monitoring program to determine levels at residential premises near the Wagoo Hills site;
6 control of non-vanadium dust (including the evaporation ponds) and an ambient monitoring program to determine levels at residential premises near the Wagoo Hills site (see condition 8);
7 surveys and management of declared rare and priority flora and vegetation;
8 a rehabilitation program which includes progressive objectives and monitoring;
9 transportation of process materials,
10 monitoring vanadium contamination in soil; and
11 protection of Aboriginal sites and liaison with traditional Aboriginals of the area ;
12 the management of the potential for fauna deaths due to the barren liquor ponds;
13 the ability to rehabilitate the barren liquor pond and heap leach pad residual solid waste; and
14 the potential presence of stygofauna in groundwater;

and shall include the following Environmental Management Plans:

1 Water Management Plan (See condition 9-2);
2 Noise and Blasting Management Plans (See conditions 10-3 and 11-3); and
3 Greenhouse Gas Emissions Management Plan (See condition 12).

7-2 The proponent shall implement the Environmental Management Program required by condition 7-1.

8 Non-vanadium Dust Levels

The Wagoo Hills Vanadium Project should not cause excessive levels of "non-vanadium dust".

8-1 The proponent shall not cause short term levels of non-vanadium bearing dust at residential premises near the Wagoo Hills site to exceed 1000 micrograms per cubic metre (ug/m^3), measured continuously over 15 minutes.

Note: The 1000 ug/m^3 limit referred to in condition 8-1 is to be considered a minimum standard to be met by the proposal. It should be understood that the project may be subject to more stringent dust limits set by the Department of Environmental Protection through Works Approval and/or Licence conditions.

9 Water Resources

9-1 Prior to any proposed significant use of the surface aquifer, the proponent shall refer such proposal to the Environmental Protection Authority.

9-2 Prior to construction, the proponent shall prepare a Water Management Plan for the Wagoo Hills site for the protection of surface and ground water resources, to the requirements of the Environmental Protection Authority on advice of the Water and Rivers Commission, Agriculture Western Australia, the Department of Minerals and Energy, and the Department of Environmental Protection.

This plan shall:

1 address the impacts of the proposed extraction on existing uses and vegetation;
2 notwithstanding the above, describe how suitable water supplies for any stock and domestic water supplies that are adversely affected by the project will be provided and how impacts on vegetation will be minimised;
3 address surface water flows affected by the project, ensuring that surface drainage is not adversely affected by the barren liquor ponds and heap leach pads;
4 outline a groundwater monitoring program to determine:
   • whether there has been any contamination arising from the operation of the mine-site, process plant, heap leach pads, barren liquor evaporation ponds and tailings dam, and
   • the level of drawdown in the upper and lower aquifers;
5 address options for reducing water demand and to what extent, if any, they will be implemented;
6 address the method of sealing the barren liquor ponds and heap leach pads to ensure the protection of groundwater; and
7 specify responsibility for monitoring, auditing of performance and compliance with the plan.

9-3 The proponent shall implement the Water Management Plan required by condition 9-2.

9-4 The proponent shall make the Water Management Plan required by condition 9-2 publicly available, to the requirements of the Environmental Protection Authority.

10 Noise

10-1 The proponent shall conduct operations so that noise emissions do not unreasonably impact on people in the vicinity of the Wagoo Hills site, including residents.

10-2 The proponent shall ensure that noise emissions meet the requirements of the noise control regulations applying from time to time under the Environmental Protection Act.

10-3 Prior to construction, the proponent shall prepare a Noise Management Plan, to include noise surveys (including baseline measurements) and assessments (including the impact of tonal noise) involving consultation with the Department of Environmental Protection, for the Wagoo Hills site, to the requirements of the Environmental Protection Authority.

10-4 The proponent shall implement the Noise Management Plan for the Wagoo Hills site required by condition 10-3.

10-5 The proponent shall make the Noise Management Plan required by condition 10-3 publicly available, to the requirements of the Environmental Protection Authority.

11 Blasting

11-1 The proponent shall conduct operations so that blasting does not unreasonably impact on people in the vicinity of the Wagoo Hills site, including residents.

11-2 The proponent shall ensure that blasting operations meet the requirements of the noise control regulations applying from time to time under the Environmental Protection Act.

11-3 Prior to construction, the proponent shall prepare a Blasting Management Plan for the Wagoo Hills site, to the requirements of the Environmental Protection Authority.

11-4 The proponent shall implement the Blasting Management Plan for the Wagoo Hills site required by condition 11-3.

11-5 The proponent shall make the Blasting Management Plan required by condition 11-3 publicly available, to the requirements of the Environmental Protection Authority.

12 Greenhouse Gas Emissions Management Plan

12-1 Prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall include:

1 calculation of the "greenhouse gas" emissions (using methodology developed for Australia);
2 measures to limit "greenhouse gas" emissions; and
3 estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product.

12-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 12-1.

12-3 The proponent shall make the Greenhouse Gas Emissions Management Plan required by condition 12-1 publicly available, to the requirements of the Environmental Protection Authority.

Note: The proponent should consider entry (whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate) into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement program.

Components of the agreement program include:

1 an inventory of emissions;
2 opportunities for abating "greenhouse gas" emissions in the organisation;
3 a "greenhouse gas" mitigation action plan;
4 regular monitoring and reporting of performance; and
5 independent performance verification.

13 Compliance Auditing

13-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

13-2 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

13-3 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

14 Decommissioning Management Plan

14-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall address:

1 removal or, if appropriate, disposal on-site of plant and infrastructure;
2 rehabilitation of all disturbed areas to agreed final land uses; and
3 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

14-2 The proponent shall implement the Decommissioning Management Plan required by condition 14-1.

14-3 The proponent shall make the Decommissioning Management Plan required by condition 14-1 publicly available, to the requirements of the Environmental Protection Authority.

15 Performance Review

15-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to evaluate the environmental performance relevant to:

1 environmental issues reported on in Environmental Protection Authority Bulletins 633, 878 and 887;

2 proponent's consolidated environmental management commitments documented in schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 Environmental Management System environmental management targets;

4 Environmental Management Programs and Plans; and

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.

Note

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

PROPOSAL

(1) VANADIUM MINING AND PROCESSING

This part of the proposal consists of a vanadium mining and processing operation 80 km south-east of Mt Magnet (see Figure 1). Vanadium pentoxide ore would be mined via open-cut and processed at the adjacent processing plant. Production rates are 2.28 Mtpa of ore and 7,200 tpa of vanadium pentoxide.

Two fuel options are considered – a combination of coal, diesel and LPG or natural gas only. Should natural gas be selected as a fuel source, a spur line from the Dampier to Bunbury pipeline would be required. This would be the subject of a separate referral to the EPA.

The layout of the main process components is shown in Figure 2.

A summary of key proposal characteristics is provided in Table 1 (attached).

The production steps are illustrated in Figure 3 and summarised as follows:

- Processing plant is located immediately adjacent to the mine site.
- Mined ore is trucked to the primary crusher dump pad.
- Ore is crushed and mixed with process water.
- Vanadium/magnetite complex is removed using magnetic separators. Tailings from this stage are inert. The tailings are thickened to recover water for process re-use then pumped to a tailings dam.
- Dewatered vanadium/magnetite concentrate is stored temporarily then mixed with sodium oxalate and sodium sulphate and calcined (roasted) in a rotary kiln. Calcination forms vanadium pentoxide and sodium vanadate.
- Calcined material is quenched with sodium vanadate liquor to form enriched vanadium liquor.
- Liquor is precipitated and filtered and dried to form ammonium metavanadate (AMV).
- AMV is fed to deammoniator and combusted to remove combined ammonium, leaving vanadium pentoxide powder.
- The powder is fed to fusion furnace.
- Molten vanadium pentoxide is flaked to produce 1-3 mm flakes which are drummed or bagged prior to transport to Fremantle for export.
- Infrastructure to support the operation includes an accommodation village, process water supply, power station and roads.

Potential atmospheric emissions include particulates (including vanadium pentoxide), sulphur oxides, nitrogen oxides, ammonia, carbon monoxide and carbon dioxide.

Solid wastes include inert tailings and calcine tailings (containing sodium salts).

(2) MINGENEW COAL PROJECT

This part of the proposal will not be implemented.

Schedule 2

Proponent's consolidated commitments

WAGOO HILLS VANADIUM PROJECT & MINGENEW COAL PROJECT (653/1146/1184)

Vanadium Mining and Processing

Precious Metals Australia Limited

Table 1. Summary of key proposal characteristics - vanadium mining & processing.

Proposal Characteristics	Units[(a)]	Proposal
Ore extraction	tpa	2.28×10^6
Production capacity (V_2O_5)	tpa	7,200
Life of mine production	years	> 15
Size of ore body	tonnes	34×10^6
Area of tenement	ha	988
Area of disturbance	ha	120
Groundwater requirements	m^3/a	2.4×10^6
Fuel Source - Option 1: Coal LPG diesel	 tpa tpa Litres/a	 30,000 – 45,000 550 - 750 15×10^6 - 17×10^6
Fuel Source - Option 2: Natural gas	 Terajoules/a	 1570 - 1930
Main reagents: Sulphuric acid Aluminium sulphate Ammonium sulphate Sodium oxalate or Sodium sulphate Sodium hydroxide Flocculant	 tpa tpa tpa tpa tpa tpa	 3,000 – 4,300 0 – 1,000 12,000 – 15,000 25,000 – 40,000 0 – 1,000 20 - 40
Atmospheric emissions - Option 1: Sulphur oxides Nitrogen oxides Carbon dioxide	 g/s g/s tpa	 3.58 (power station) 11.3[(b)] (rotary kiln) 31 (power station) 17.6 (rotary kiln) 124,301 – 148,394
Atmospheric emissions – Option 2: Sulphur oxides Nitrogen oxides Carbon dioxide	 g/s g/s tpa	 < 1[(b)] (from any source) < 1 (from any source) 89,961 – 91,875
Tailings (inert)	tpa	$1.5 \times 10^6 – 1.7 \times 10^6$
Calcined tailings	tpa	0.65×10^6
Truck movements	trucks/day	4 – 7

(a) Definitions of units:
"tpa" means tonnes per annum;
"m^3/a" means cubic metres per annum;
"g/s" means grams per second; and
"ha" means hectares (1 ha = 10,000 square metres).

(b) There is some uncertainty regarding this value. In the event that sulphate is recycled back into the process, the emission rate from the rotary kiln is likely to increase.

Schedule 2

PROPONENT'S CONSOLIDATED ENVIRONMENTAL MANAGEMENT COMMITMENTS FOR THE WAGOO HILLS VANADIUM PROJECT

April 1992, March 1998

Note : commitments appearing in italics are commitments made in 1998

(1) Implement measures in the process plant to conserve water.

(2) Submit a detailed composition of the coal to the EPA and Department of Minerals and Energy to assist in designed management plans.

(3) Submit final design details of exhaust stacks and exhaust cleaning devices prior to construction for approval by the EPA as part of the Environmental Management Program.

(4) Undertake modeling of principal atmospheric contaminants prior to plant construction.

(5) Implement atmospheric monitoring program.

(6) Ensure that vanadium dust is controlled to below limits established in the Mines Safety and Inspection Act 1994, by incorporating dust extraction and collection equipment in the process plant.

(7) Design and rehabilitate all waste dumps in consultation with the Department of Minerals and Energy and in accordance with the "Guidelines for Waste Dump Design and Rehabilitation" of that Department.

(8) Work cooperatively with the Shire of Mount Magnet, other government bodies and other users of the portion of unsealed road affected by the Wagoo Hills Project to ensure that the road is satisfactorily maintained.

(9) Develop a transportation management and contingency plan to ensure that the transportation of hazardous materials is undertaken safely. A driver training program will be incorporated into the plan and will include regular review of driver awareness. Similarly, the integrity of transportation equipment will be monitored on a regular basis. The transportation management and contingency plan will be developed in consultation with the Explosives and Dangerous Goods Division of the Department of Minerals and Energy and the Western Australian Hazardous Materials Emergency Management Scheme (WAHMEMS).

(10) An EMP will be prepared prior to construction commencing which provides detailed design information on dust control systems. These will be prepared to the satisfaction of the EPA on the advice of the Pollution Prevention Division.

(11) All process areas are sealed with impermeable floors and bunded to permit ready clean-up of spillages, which are potential dust sources.

(12) The calcined tailings dump is continuously wetted to prevent wind blown dust.

(13) PMA will develop a Spill Management Plan which requires immediate clean-up of spills with any contaminated materials or soils being recycled through the process.

(14) Minimise clearing of land consistent with safe and efficient operations.

(15) Develop a management strategy to minimise the spread of saffron thistle. This strategy will be developed in consultation with Agriculture WA.

(16) Maintain strict fire control procedures.

(17) Ensure that all handling, packaging and road transport of inputs to the process plant and products from that plant comply with the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail and the Dangerous Goods Regulations 1992.

(18) Prohibit domestic pets in the project area as a condition of employment.

(19) Restrict off-road driving and prohibit hunting by employees as a condition of employment.

(20) Develop an effective operator training and awareness program to ensure that the process plant is well operated and any potential occupational health problems are quickly identified and are rectified immediately.

(21) *In order to protect the health of employees a comprehensive health and safety plan will be developed for the site which will address the following issues:*

- *Frequent occupational monitoring of airborne vanadium levels within works areas.*
- *Regular personal air sampling of employees working in areas with potential exposure to vanadium.*
- *Regular health assessment and urine tests for employees.*
- *Provision of, and training in the correct use of personal protective equipment.*
- *A comprehensive training program in the hazards associated with vanadium for all employees.*
- *Strict segregation of mess and meal break areas from process areas with clear procedures to ensure that contaminated protective clothing cannot enter mess areas.*

(22) The proponent will prior to commencing construction develop a water management plan to the satisfaction of the EPA on advice from the Water and Rivers Commission which demonstrates that the borefield will operate in a sustainable manner.

(23) Undertake to guarantee continuity of stock water if changes in groundwater levels, caused by the Project, adversely affect pastoral activities.

(24) Guarantee to provide the Pastoral Lessee with a potable water supply if the project adversely affects his current source of fresh water.

(25) Prepare drainage management plans for the vanadium mine and process plant at Windimurra in consultation with the Department of Minerals and Energy.

(26) Design the tailings dams in consultation with the Department of Minerals and Energy and in accordance with the "Guidelines on the Safe Design and Operating Standards for Tailings Storages" of that Department.

(27) The proponent will manage calcined tailings by utilising a lined tailings dump fitted with a drainage extraction for the return of leachate to the process.

(28) Storage of hazardous materials will be undertaken in consultation with the Department of Minerals and Energy Explosives and Dangerous Goods Division.

(29) Submit a final design of the storage facility for the sodium salt reagent at Windimurra to the Department of Minerals and Energy and the EPA for approval as part of the Environmental Management Program prior to the construction of the process plant.

(30) Design and implement a monitoring program of groundwater levels and water quality in the borefield and other bores in the vicinity of the project area at Windimurra before operational start and to the satisfaction of the Water and Rivers Commission.

(31) Prepare a Greenhouse Gas management plan.

(32) Rehabilitate the surrounds of the vanadium mine site and the process plant and village areas at the Windimurra following decommissioning of the project.

(33) Prepare specific proposals for site decommissioning in the event of termination of the project and implement those proposals after review and approval of the relevant Government Agencies at the time.

(34) Undertake a vegetation survey over the area affected by the mine and process plant and prepare a vegetation management plan.

(35) Liaise with the traditional Aboriginals of the region as required.