Expansion of Existing Titanium Dioxide Pigment Facility to 195,000 tpa, Kemerton Industrial Park

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Millennium Inorganic Chemicals Ltd

(formerly SCM Chemicals Ltd)

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

The proponent, Millennium Inorganic Chemicals Ltd (formerly SCM Chemicals) proposes to expand its existing titanium dioxide facility in Kemerton to increase the nominal production of finished titanium dioxide pigment to 195,000 tonnes per annum (tpa). The existing titanium dioxide facility is located in the Kemerton Industrial Park within the Shire of Harvey, 140 km south of Perth, 17 km north-east of Bunbury and 4 km east of the Leschenault Estuary.

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment, on the environmental factors, conditions and procedures relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant Environmental Factors

Although a number of environmental factors were considered by the EPA in the assessment, it is the EPA's opinion that the following are the environmental factors relevant to the expansion proposal which require detailed evaluation in the report:

(a) air emissions - including sulphur dioxide (SO_2), odours (H_2S), carbonyl sulphide (COS), chlorine, oxides of nitrogen (NOx), titanium tetrachloride ($TiCl_4$), carbon monoxide (CO) and dust;

(b) greenhouse gases;

(c) noise;

(d) marine discharge;

(e) solid residue;

(f) groundwater quality;

(g) water resources; and

(h) public safety.

Conclusion

The EPA has considered the proposal by Millennium Inorganic Chemicals to expand its existing titanium dioxide facility at Kemerton. The EPA considers that the proposal can be managed to meet the EPA's objectives and thus not impose an unacceptable impact on the environment, provided that the conditions recommended in Section 4 and set out in detail in Appendix 3, are imposed.

Recommendations

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

1. That the Minister considers the report on the relevant environmental factors of air emissions, greenhouse gases, noise, marine discharge, solid residue, groundwater quality, water resources and public safety, as set out in Section 3.

2. That the Minister notes that the EPA has concluded that the proposal can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

3. That the Minister imposes the conditions and procedures consistent with Section 4 and set out in detail in Appendix 3 of this report.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by Millennium Inorganic Chemicals to expand its existing titanium dioxide facility at Kemerton is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) in order to manage the environmental impacts of the proposal, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction of the expanded plant, the proponent shall demonstratethat the environmental management system in place includes the following elements:

- an environmental policy and corporate commitment to it;
- mechanisms and processes to ensure:
  - planning to meet environmental requirements;
  - implementation and operation of actions to meet environmental requirements;
  - measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes;

(c) in order to successfully carry out the decommissioning of the plant and rehabilitation of the site and its environs, the proponent shall prepare and implement a decommissioning and rehabilitation plan; and

(d) the proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Contents

	Page
Summary and recommendations	i
1. Introduction and background	1
2. The proposal	2
3. Environmental factors	9
3.1 Relevant environmental factors	9
3.2 Air emissions	10
3.3 Greenhouse gases	20
3.4 Noise	21
3.5 Marine discharge	22
3.6 Solid residue	25
3.7 Groundwater quality	27
3.8 Water resources	29
3.9 Public safety	31
4. Conditions	35
5. Conclusion	36
6. Recommendations	36

Tables

1.	Components of the expansion	8
2.	Estimated inputs and outputs from the expansion	9
3.	Identification of relevant environmental factors	11
4.	Summary of assessment of relevant environmental factors	13

Figures

1.	Regional location	3
2.	Titanium dioxide chloride process	4
3.	Finishing process	5
4.	Proposed plant layout	6
5.	Water pipeline route	7
6.	Existing water treatment process	23
7.	Water balance	30
8.	Risk contours for the expanded plant	32
9.	Combined risk contours for the expanded plant and Nufarm plant	33

Appendices

1. List of Submitters
2. References
3. Recommended environmental conditions and proponent's commitments

1. Introduction and background

The proponent, Millennium Inorganic Chemicals Ltd (formerly SCM Chemicals) proposes to expand its existing titanium dioxide facility at Kemerton to increase the production of finished titanium dioxide pigment to 195,000 tonnes per annum (tpa). The existing titanium dioxide facility is located in the Kemerton Industrial Park within the Shire of Harvey, 140 km south of Perth, 17 km north-east of Bunbury and 4 km east of the Leschenault Estuary (Figure 1). The industrial park is the principal site for heavy industry in the south-west region of Western Australia. There are currently four other industries located at Kemerton, namely Nufarm, Simcoa, BOC and Cockburn Cement.

The proponent currently operates a titanium dioxide (chloride process) plant at Kemerton and a finishing/packaging plant and support facilities at Australind, 8 km south of the Kemerton plant, producing 79,000 tpa of finished titanium dioxide pigment. The existing Kemerton plant has been in operation since 1989 following an EPA assessment (EPA, 1987). The Australind plant has been in operation since 1963 (EPA, 1987). The raw titanium dioxide produced at the Kemerton plant (in slurry form) is currently transported in tankers to the Australind plant by road, for further treatment (ie finishing) to form finished pigment and for packaging. Liquid waste from the Australind plant is also transported to the Kemerton plant for reuse/treatment and subsequent disposal via an ocean outfall. Solid residue is currently transported by road tanker to the solid residue storage area at Dalyellup, south of Bunbury for disposal. The Dalyellup site has been approved for storage of the residue, following assessments by the EPA (EPA, 1991 and 1993a).

Titanium dioxide is a non-toxic, white pigment used in the manufacture of a wide range of products including paint, paper, plastics and rubber to make them opaque. This pigment is produced from synthetic rutile ore, which is produced from mineral sands by a variety of suppliers in Western Australia. Main process gases are supplied externally from the nearby Nufarm plant (chlorine) and BOC plant (nitrogen and oxygen) via pipelines.

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 the EPA's recommendations.

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

The DEP's summary of submissions and the proponent's response to those submissions have been published separately and are available in conjunction with this report.

2. The proposal

The expansion proposal is to increase the nominal production capacity of the existing Kemerton/Australind operations from the current level of 79,000 tpa to 195,000 tpa of finished titanium dioxide, by modifying the existing titanium dioxide chloride process plant and establishing a new finishing plant (with a capacity to produce an additional 116,000 tpa of finished pigment) at Kemerton, while maintaining the operation of the existing finishing plant at Australind.

The existing titanium dioxide chloride process plant is located in the Kemerton Industrial Park (Figure 1).

The processes used for the expanded facilities will be identical to the existing processes. The chloride process to produce raw titanium dioxide pigment is based on chlorination of synthetic rutile to produce titanium tetrachloride ($TiCl_4$), an intermediate product, and subsequent oxidation of the $TiCl_4$ to produce raw pigment (Figure 2). The finishing process involves chemical treatments and drying of the raw titanium dioxide to form various grades of finished pigment.

The chloride process can be separated into eight distinct sections, which are: ore handling (Unit 100), chlorination, purification (Unit 200), oxidation (Unit 300), Pre-finishing (Unit 400), gaseous effluent handling (Unit 500), effluent treatment (Unit 550) and utilities (Figure 2).

The chloride process plant modifications involve duplication of some equipment to provide a secondary stream, upgrading existing equipment to provide approximately twice the capacity, and installation of a new thermal conversion unit. The new finishing plant includes pigment treatment and vacuum filters, driers, pigment mills and packaging equipment (Figure 3).

Some of the items of the expanded chloride process plant can be accommodated alongside the existing units. The new chlorination and oxidation streams and plant support facilities would be located south of the existing chlorinator section (Figure 4). The new finishing plant would be located to the west of the existing plant (Figure 4).

Extra chlorine, compressed nitrogen and oxygen would be required, through either replacement of the existing pipelines or installation of additional pipelines.

In addition to its own process water, the expanded plant would continue to accept wastewater from other sources (the chlor-alkali plant, air separation plant and lime plant) for treatment and subsequent ocean disposal via a pipeline (Figure 5).

The main aspects of the proposal are provided in Table 1.

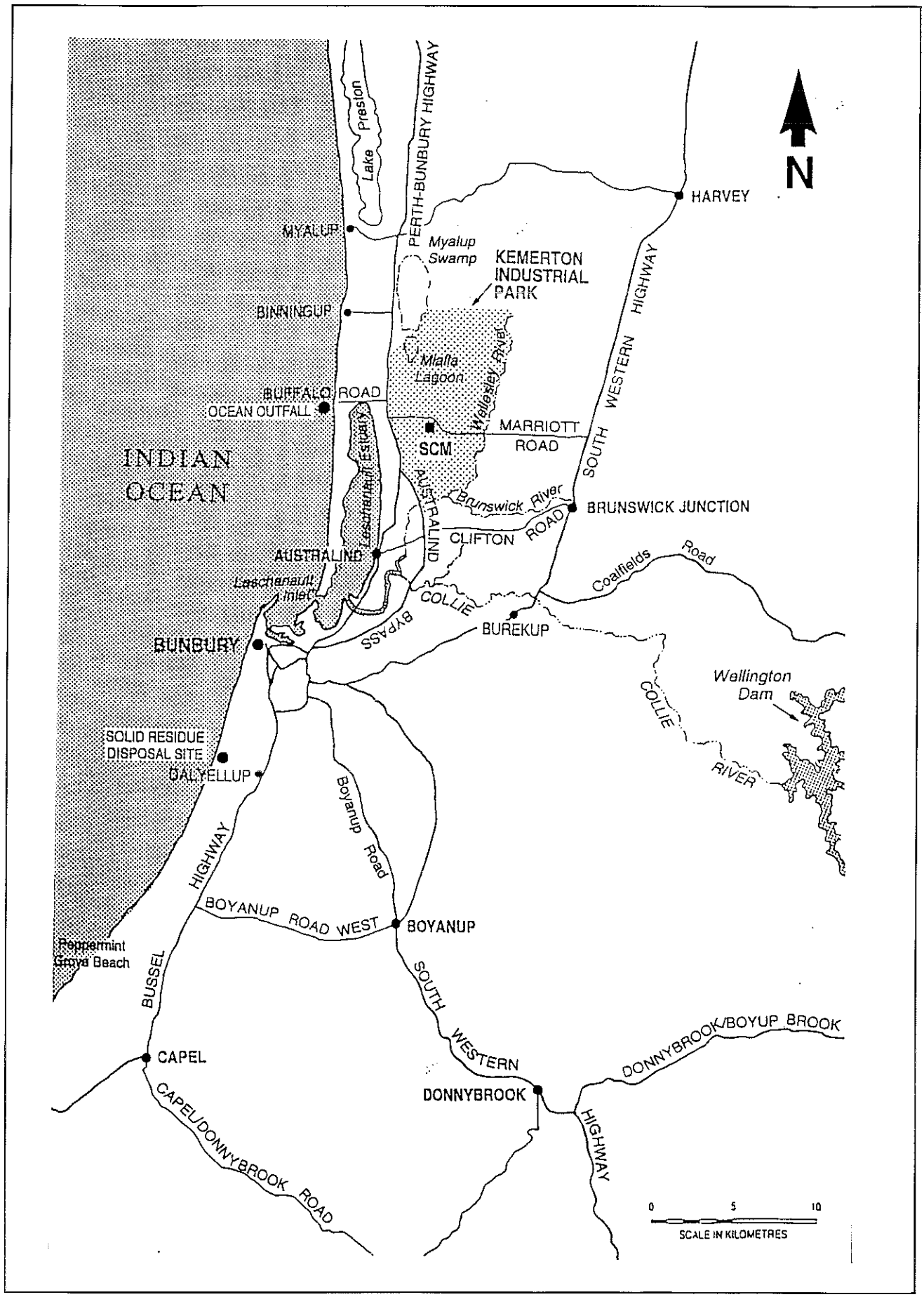

Figure 1. Regional location

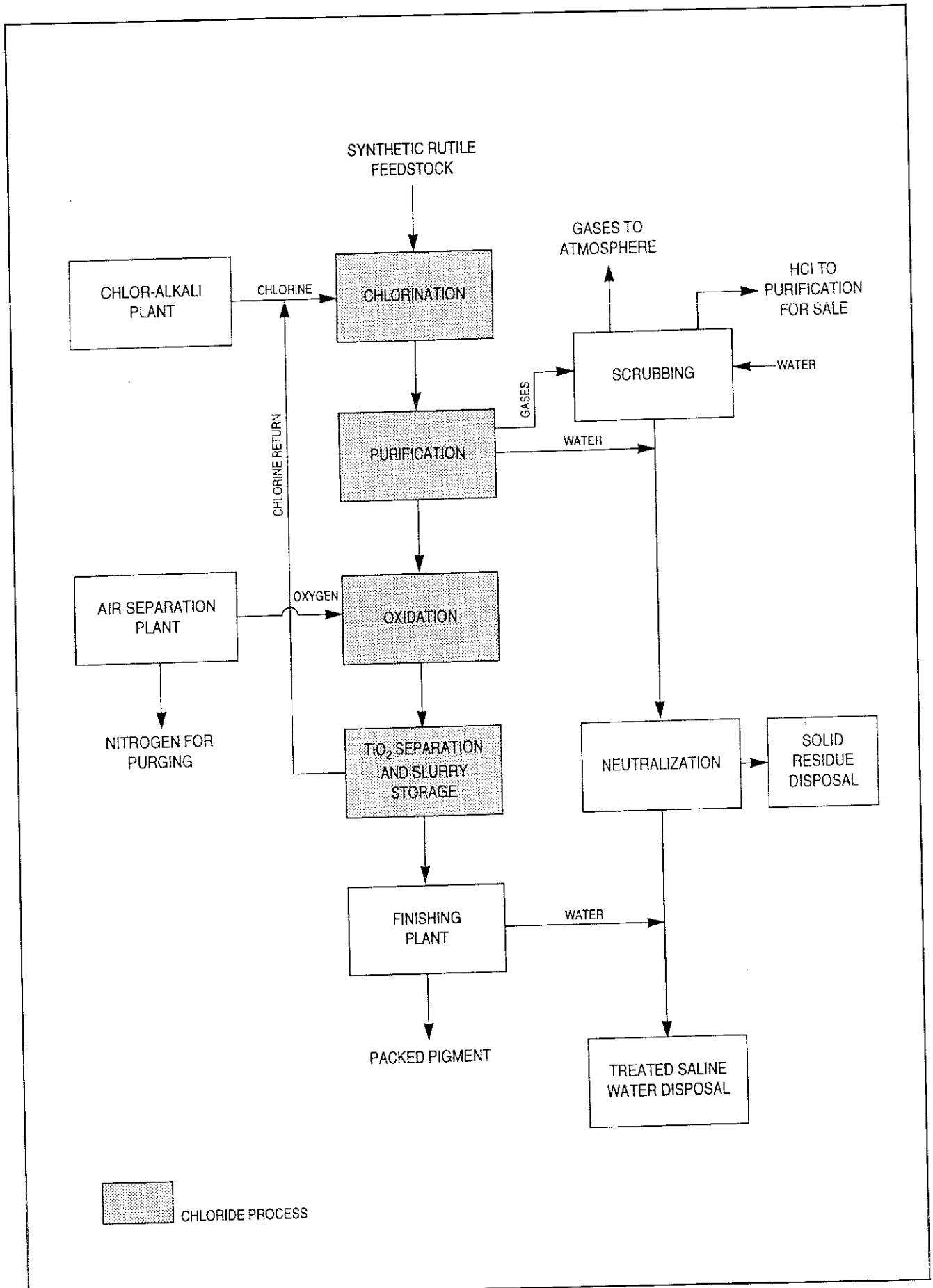

Figure 2. Titanium dioxide chloride process.

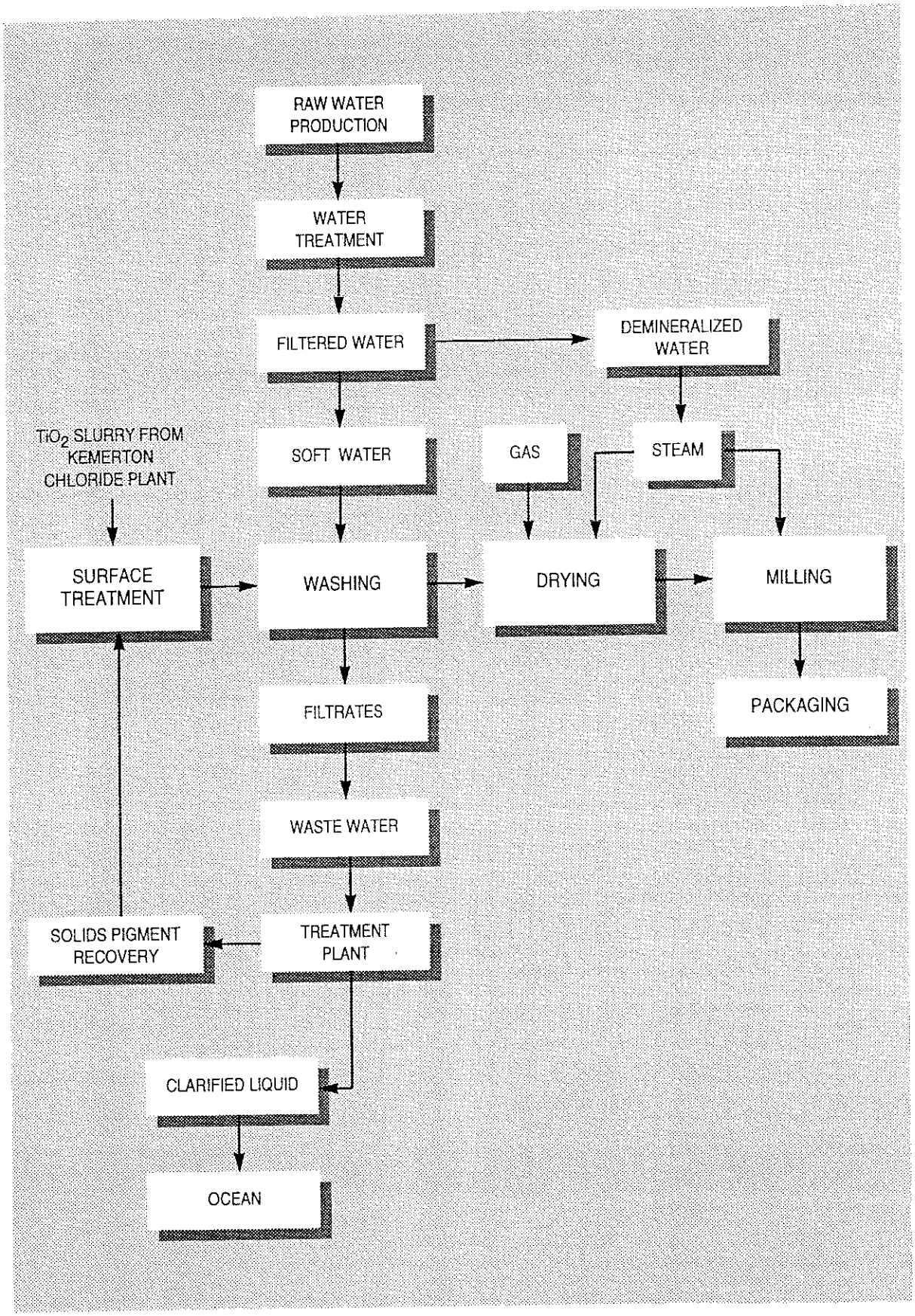

Figure 3. Finishing process.

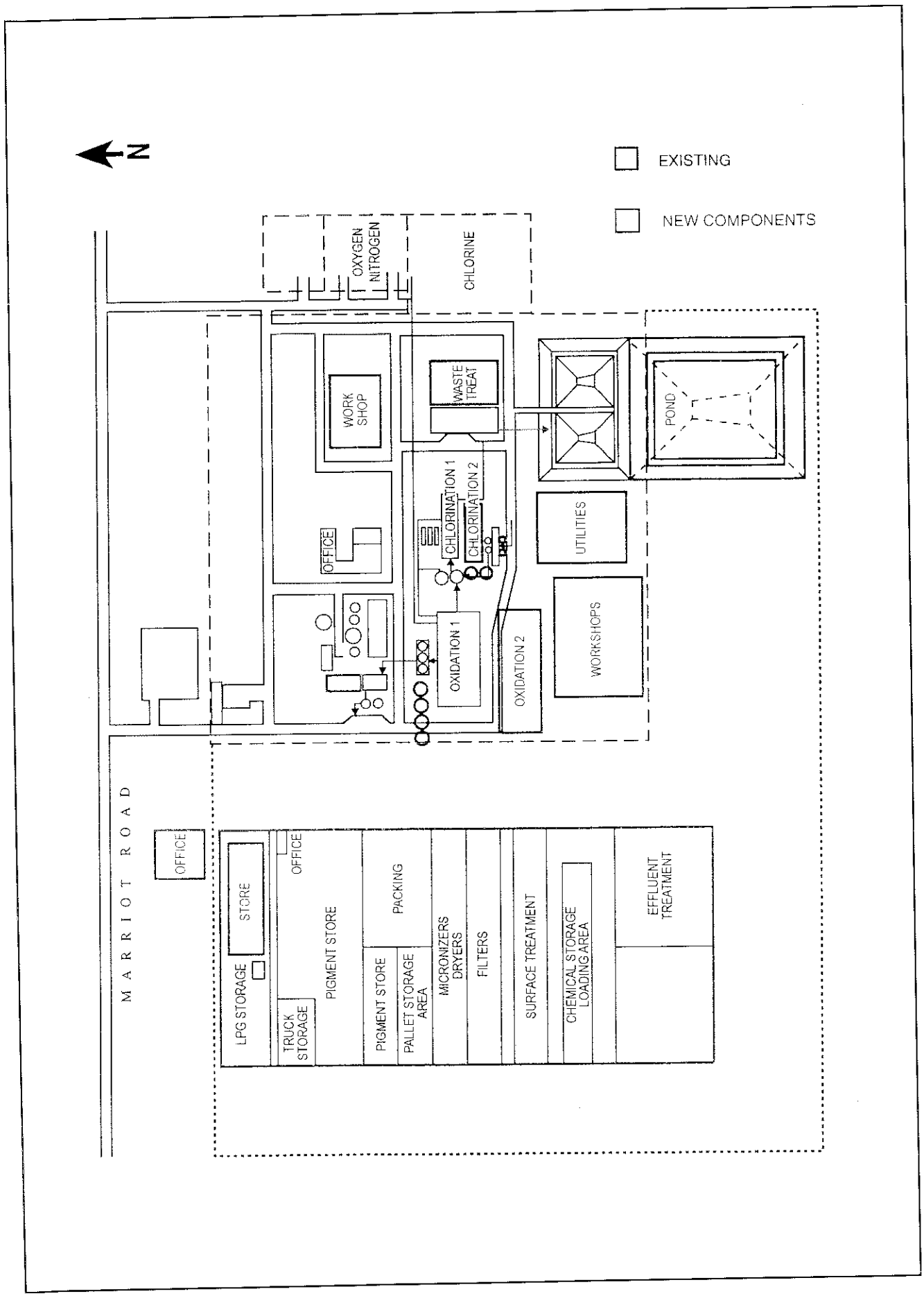

Figure 4. Proposed plant layout.

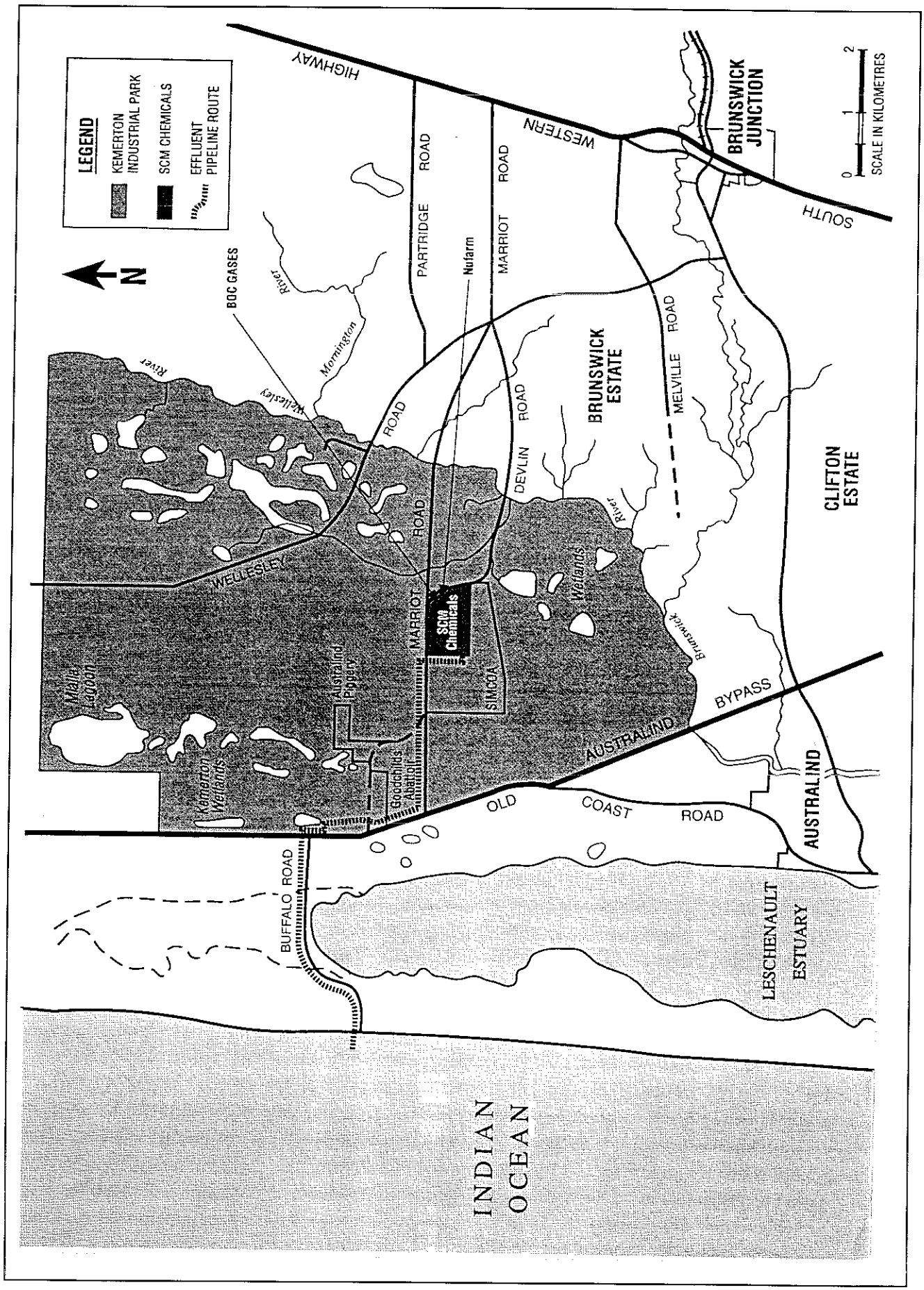

Figure 5. Water pipeline route.

Table 1. Components of expanded chloride process plant and new finishing plant.

Section	Components
Ore and coke handling	Add two new storage silos Add five new conveying systems Modify ore elevator to feed new silos
Chlorination	Add two new chlorinators Add one new cold cyclone Add one new sluice system
Condensation/purification	Add one new primary condenser Add one new secondary water cooled condenser Add one new brine cooled condenser Add two new brine refrigeration systems Add new purification system
Oxidation	Add new $TiCl_4$ and oxygen heaters Add new aluminium chloride generator Add one new reactor Add new bag filter Add four new slurry storage tanks Add ten new media mills
Finishing	Build two identical lines consisting of • one treatment tank • three wash filters • one drier • two fluid energy mills Add four pigment recovery thickeners Add chemicals make-up and storage facilities Add four bag packaging machines Add one semi-bulk packaging machine
Waste treatment	Add new process stack and scrubber Extend piping from existing maintenance scrubber Add thermal converter and waste heat boiler Extend suction vent system Add one new neutralisation system Upgrade pipeline to ocean
Utilities	Upgrade primary electrical substation Replace water treatment system Replace boiler Add new five-cell cooling tower Upgrade utility distribution system
Buildings	Expand workshops Expand laboratories Add new offices Add lunch room, change rooms and toilets Upgrade technical and engineering offices Add finished product warehouse Add materials stores Upgrade computer system

The estimated inputs and outputs from current titanium dioxide plant and proposed expansion are shown in Table 2 below:

Table 2. Estimated inputs and outputs from current and proposed titanium dioxide plant*

Material	Unit	Current	Proposed	Absolute Variance	% Variance
Production	tpa	79,000	195,000	116,000	147
Inputs					
Synthetic Rutile	tpa	84,000	206,000	122,000	145
Petroleum Coke	tpa	18,000	42,000	24,000	133
Chlorine	tpa	16,000	35,000	19,000	119
Oxygen	tpa	39,000	96,000	57,000	146
Nitrogen	tpa	59,000	145,000	86,000	146
Water	tpa	1,500,000	5,000,000	3,500,000	233
Natural Gas	Gjpa	370,000	980,000	610,000	165
Electricity	Mwh	29,000	97,000	68,000	234
Outputs					
Wastewater	m^3	950,000	3,000,000	2,050,000	216
Residue Slurry	tpa	141,000	397,000	256,000	182
CO	tpa	6,700	3,600	(-)3,100	(-)46
CO_2	tpa	70,000	194,000	124,000	177
$TiCl_4$	tpa	<0.5	<0.5	nil	nil
Cl_2	tpa	<0.5	<0.5	nil	nil
HCl	tpa	<0.5	<0.5	nil	nil
COS	tpa	540	540	nil	nil
SO_2	tpa	200	240	40	20
H_2S	tpa	<0.5	<0.5	nil	nil
NO_X	tpa	25	60	35	140
N_2	tpa	59,000	145,000	86,000	146

* Assumes thermal converter on-line 75% of the time

The potential impacts of the proposal are provided by the proponent in the CER document (Kinhill, 1997) and their proposed management is summarised in Table 7.6 of the CER.

3. Environmental factors

3.1 Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

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

(a) air emissions - including sulphur dioxide (SO_2), odours (H_2S), carbonyl sulphide (COS), chlorine, oxides of nitrogen (NOx), titanium tetrachloride ($TiCl_4$), carbon monoxide (CO) and dust;

(b) greenhouse gases;

(c) noise;

(d) marine discharge;

(e) solid wastes;

(f) groundwater quality;

(g) water resources; and

(h) public safety.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the CER document and the submissions received, in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponent's response and commitments, and the effectiveness of current management. On this basis, the EPA considers that other issues raised in the submissions, including traffic movements, visual impacts, construction impacts and clearing of 13.5ha of vegetation, do not require further evaluation by the EPA. The identification process is summarised in Table 3.

The relevant environmental factors are discussed in Sections 3.2 to 3.10 of this report, and the EPA's assessment is summarised in Table 4.

3.2 Air emissions - including sulphur dioxide (SO_2), odours (H_2S), carbonyl sulphide (COS), chlorine, oxides of nitrogen (NOx), titanium tetrachloride ($TiCl_4$), carbon monoxide (CO) and dust

Description

Air emissions would arise from the main process/thermal converter stack, suction vent system stack, emergency high pressure release system, start-up stack and boilers and gas burning devices.

With the existing plant, all process gaseous emissions pass through a multiple water scrubbing system to remove particulates, hydrogen chloride and chlorine prior to discharge to the atmosphere through a 66 m stack. The exit gases currently contain nitrogen, carbon dioxide, carbon monoxide, carbonyl sulphide, hydrogen sulphide and water vapour.

The new plant would incorporate a similar system in which all process gas emissions from the existing and expanded raw pigment plant would pass through a gas scrubbing train, consisting of a spray tower, a venturi scrubber and a packed tower. In addition, the scrubbed gases would be passed through a thermal converter system where carbon monoxide, carbonyl sulphide and hydrogen sulphide would be oxidised to carbon dioxide and sulphur dioxide. The energy released in the thermal converter would be used to generate steam in a waste heat boiler.

The thermal converter exhaust gases would be scrubbed in a caustic scrubber to remove 95% of the resultant sulphur dioxide and then vented to the atmosphere through the new main process stack, currently proposed to be 90 m high. The resulting scrubber solution would be oxidised in a process developed by the proponent, to produce a sulphate solution that would be injected into the saline water for disposal. The atmospheric emissions would be mainly carbon dioxide and nitrogen (95%) with minor proportions of nitrogen oxides, carbon monoxide and sulphur dioxide (the remaining 5%).

Table 3: Identification of relevant environmental factors

Factor	Relevant Area	Proposal Characteristics	Government Agencies (including DEP) and Public Comments	Identification of Relevant Factors
Air emissions - including sulphur dioxide (SO_2), odours (H_2S), carbonyl sulphide (COS) chlorine (Cl), oxides of nitrogen (NOx), titanium tetrachloride ($TiCl_4$) carbon monoxide (CO) and dust	Kemerton Industrial Park and surrounding area, including nearby residences.	• 20% increase in SO_2 emissions. • 46% decrease in CO emissions. • dust emission will meet AEC/NHMRC guidelines. • Potential increase in rate of occurrence of fugitive emissions of gases (such as $TiCl_4$ and Cl) and dust, but manageable through equipment design and existing operational procedures. • venting of odorous gases during thermal conversion system by-pass is not likely to pose a problem to nearby residents. • insignificant increase in Cl, HCl and COS and odours in stack emissions and ground level concentrations, under normal operating conditions.	• more detailed information is required on: - air emissions and their predicted impacts, particularly under thermal converter by-pass conditions; - scrubbing train and emission control equipment; and - management of dust and other fugitive emissions. • proponent should clearly indicate impacts of increase in total mass of gaseous emissions; • the EPA's assessment should stipulate minimum acceptable standards for gaseous emissions, and should require monitoring for compliance	**Considered to be a relevant factor**
Greenhouse gases.	Kemerton Industrial Park and surrounding area, including nearby residences.	• 177% increase in CO_2 emissions, 20% increase in SO_2 emissions and 140% increase in NOx, but plant is only a small green house gas emitter (194,000 tpa CO_2, 240 tpa SO_2 and 60 tpa NOx).	• proponent should predict current and projected greenhouse gas emissions and put forward a plan to reduce them; • proponent should be encouraged to join the Greenhouse Challenge programme.	**Considered to be a relevant factor**
Noise	Kemerton Industrial Park and surrounding area, including nearby residences.	• total predicted sound power level from the expanded plant is expected to increase by about 7 dB, to 123 dB.	• more information on noise modelling to demonstrate compliance with the assigned noise levels, and that the expanded plant is not a significant noise contributor.	**Considered to be a relevant factor**
Marine discharge	Area within 200 metres of ocean outfall and pipeline.	• 216% increase in effluent discharge to ocean outfall (offshore from the Leschenault Peninsula), but concentrations of contaminants remain about the same. • total volume of wastewater would be 3 million m3 per year at a flow rate of about 376m3/h.	• need to define pipeline configurations and mixing zone; • more information on monitoring of the receiving environment, including water, sediment and biota quality outside the mixing zone; • proponent should commit to discharge its wastewater via the proposed single pipeline for the discharge of KIP to ocean; • further environmental studies should be required to determine the impacts of increase in wastewater discharge volume on the ocean environment; • current method of ocean discharge is not satisfactory since effluent should be treated to remove radioactive waste and toxic substances before it is discharged.	**Considered to be a relevant factor**

Solid residue	Disposal sites and transport routes.	• 182% increase in residue slurry which will continue to be transported to Dalyellup solid waste disposal site. • quantity of solid residue slurry would be 397,000 tpa (containing 10-15% solids at a pH of 8-10) • composition of residue solids (containing low level radionuclides) would be maintained.	• details on results of solid waste minimisation programme should be provided; • increase in solid wastes should require a long term strategy; • the expansion should not be approved until a more satisfactory, long term solid waste disposal option has been selected and approved.	**Considered to be a relevant factor**
Groundwater quality	Plant site and area down hydraulic gradient from the site.	• potential increase in contamination threat to groundwater.	• more information on groundwater monitoring programmes and safeguards.. • concern about past groundwater contamination at the adjacent Nufarm site and the potential increase in contamination threat to groundwater from the expansion; • since the pipeline carries large volume of saline water and traverses sensitive groundwater areas, monitoring of the pipeline is required for early detection of pipe breakages.	**Considered to be a relevant factor**
Water resources	Kemerton Industrial Park and surrounding area, including nearby residences.	• 233% increase in water requirement.	• the existing plant is a large consumer of groundwater and water supply sources for the expansion should be defined. • water supply option from Wellington Dam is out of date; • in association with the Office of Water Regulation, Water Corp is examining the water service options for the park. • although WRC would conditionally support the proposed options for water supply, proponent should provide more information on the sources of water supply; • proponent must develop a water management plan to reduce groundwater use by using other sources and by recycling of process waste.	**Considered to be a relevant factor**
Public safety.	Kemerton Industrial Park and surrounding area, including nearby residences.	• main hazards are from toxic releases of chlorine, hydrogen chloride and $TiCl_4$. • individual and societal risk levels and cumulative risks from both SCM and Nufarm expansions meet acceptable criteria. • SCM and Nufarm combined risk map shows that the risk contour of 1x10-7 per year is increased by about 200m eastward.	• QRA results indicate that EPA's individual risk criteria will be met, and societal risk is not an issue; • plan and procedures to manage public risk during construction period (where construction activity is occurring around operating plant), and review of the THCP for the expanded plant are required; and • a Safety Report will be required prior to commissioning of the expansion.	**Considered to be a relevant factor**
Others including traffic movement, visual impacts, construction impacts and clearing of about 13.5 ha of vegetation on the plant site	Kemerton Industrial Park and surrounding area, including nearby residences.	• The plant site is within the heavy industry policy area. • Impacts of traffic movement, visual impacts and construction impacts are low and manageable. • The site had previously been cleared for agriculture purposes and the present vegetation cover (jarrah, sheoak, marri and shub species) results from natural regeneration following cessation of grazing and agricultural activity.	No concern was raised regarding these aspects of the project.	**Factors do not require further EPA evaluation**

Table 4: Summary of assessment of relevant environmental factors

Factor	Relevant Area	EPA Objectives	EPA's Assessment	EPA's Advice
Air emissions - including sulphur dioxide (SO_2), odours (H_2S), carbonyl sulphide (COS) chlorine, oxides of nitrogen (NOx), titanium tetrachloride ($TiCl_4$) carbon monoxide (CO) and dust	Kemerton industrial Park and surrounding area, including nearby residences.	• best practice measures to minimise air emissions; • meeting current air emission guidelines and air quality standards, including AEC/NHMRC, NEPM, WHO, draft DEP guidelines; and • emissions do not adversely affect the environment or health, welfare and amenity of nearby land users.	• installation of a gas scrubbing train, consisting of a spray tower, a venturi scrubber and a packed tower (to remove particulates, $TiCl_4$, HCl and Cl), a thermal converter system (to oxidise H_2S, CO and COS) and a caustic scrubber (to remove SO_2), prior to venting via a new 90m stack, would minimise stack emissions and GLCs, under normal operating conditions. • under thermal converter by-pass conditions (max 25% down time for maintenance and modifications), GLCs would still meet acceptable standards and will be at least equivalent to existing levels, since process gases would continue to be scrubbed with caustic soda (80-90% scrubbing efficiency for H_2S and SO_2). • fugitive emissions would be collected by an expanded suction vent system and will be scrubbed before being vented via the existing 66m tall stack. • dust control would be achieved by building design, bag filter dust collection systems (100 mg/m3 dust emission design), and operational controls and procedures. **Proponent's commitments:** • install an integrated thermal converter system, to reduce COS, H_2S and CO emissions and recycle waste heat. • install a scrubber system capable of removing 95% of SO_2. • design the new process stack and emergency stack to ensure no uacceptable impacts to nearby residences.	Having particular regard to: • the acceptable air quality standards and limits applicable to this expansion; and • the proponent's commitments and proposed management to minimise air emissions, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable

Greenhouse gases.	global environment.	Ensure that greenhouse gas emissions are minimised in accordance with the EPA interim Guidance No. 12 - "Minimising Greenhouse Gas Emissions" (June 1998).	• emissions would be managed according to greenhouse gas control strategy, which aims to improve energy efficiency and minimise the net generation of greenhouse gases, including reducing CO_2 through reusing the heat generated in the waste heat boiler in the thermal converter, removing SO_2 through scrubbers, reducing NOx through the use of high efficiency, low NOx burners and tree planting programme. **Proponent's commitments:** • enter into "Greenhouse Challenge" voluntary agreement. • use acceptable methodology to estimate gross greenhouse gas emissions, gross removal by either sink enhancement programmes or CO_2 stabilising techniques. • indicate intended measures and efficient technologies to be adopted	Having particular regard to: • the requirements of the EPA interim Guidance No.12 - "Minimising Greenhouse Gas Emissions" (June 1998); • the proponent's proposed management to reduce emissions of greenhouse gases, in terms of improve energy efficiency in the process; • the proponent's commitments on greenhouse gas emissions; and • the expanded pigment plant being a small greenhouse gas emitter, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable
Noise	Kemerton industrial Park and surrounding area, including nearby residences.	• Noise emissions to meet assigned noise levels required in the Environmental Protection (Noise) Regulations 1997, for the expansion and for the KIP. • EP Act, Section 51 which requires all reasonable and practicable measures to be taken to minimise discharge.	• noise modelling (ENM programme) shows that predicted noise levels at the nearest residence are below 35 dB(A), which is 5 dB(A) below the assigned noise level for outside the KIP, thus the expanded plant would not likely to be a significant noise contributor. • compliance with the assigned noise level of 65 dB(A) along the southern boundary could be achieved, through relocation of noise sources and/or simple noise control. **Proponent's commitments:** • final plant design will incorporate appropriate noise control measures to ensure compliance with the assigned noise emission levels for the expanded plant in KIP.	Having particular regard to: • the requirements of the *Environmental Protection (Noise) Regulations 1997* ; and • the proponent's commitments to meet the assigned noise levels in the regulations; it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable

Marine discharge	Area within 200 metres of ocean outfall and pipeline.	• Marine water quality is maintained or improved, and where possible, impacts upon locally significant marine flora, fauna and vegetation communities are avoided. • To meet draft WA Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711, 1993) and EQC/EQOs recommended by DEP in the SMCW Study (1996) • To comply with the Radiation Safety Act 1975 and Regulations. • To comply with statutory standards for effluent discharges.	• in addition to its own process water, the expanded plant would accept water from other sources (chlor-alkali plant, air separation plant and lime plant) for treatment and subsequent disposal. • treated saline waters would be pumped to the existing ocean outfall. • existing pipeline would require a new larger pipeline and diffuser, or a second pipeline. • final design of ocean outfall would ensure adequate mixing and compliance with water quality guidelines outside the mixing zone (approximately 20m from the discharge point) • a review of current monitoring has been undertaken and the resulting future monitoring proposal, which is designed to test the hypotheses that there will be "no significant" change in relation to water, sediment and biota quality outside the mixing zone, is supported by the DEP. • radiological aspects have been considered in the monitoring programme for the wastewater treatment system, the saline wastewater and the receiving environment. • continuous monitoring of wastewater effluent for flow rate, temperature, pH, turbidity, heavy metals and radionuclides will continue. **Proponent's commitments:** • continue investigation and monitoring of the receiving environment to the satisfaction of DEP. • continue to operate and monitor the wastewater treatment plant and effluent discharge to ocean. • develop an ocean outfall diffusion system to maintain or improve dispersion of wastewater. • if the waste water disposal system is not provided by the Water Corp, submit a detailed wastewater disposal system proposal for the expansion to the DEP/EPA for assessment, prior to commissioning of the expanded plant. • alter the wastewater disposal system if problems are detected. • continue to implement the Radiation Management Plan (RMP) approved by the Radiological Council, and audit its effectiveness.	Having particular regard to: • the proponent's proposed management and commitments to ensure no significant change in relation to water, sediment and biota quality outside the mixing zone; • the requirements of the DEP's licence conditions and the *Radiation Safety Act 1975* and the *Radiation Safety (General) Regulations 1983*; and • acceptable marine water quality standards, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable

Solid residue	Disposal sites and transport routes.	• Waste minimisation and recycling. • Potential contamination of soil, surface and ground water is avoided, and radiological impacts are kept as low as reasonably achievable by - complying with statutory requirements including the Radiation Safety Act 1975; and - meeting Draft WA Guidelines for Fresh and Marine Waters	• reduction in solid residue output by 40% was achieved following the construction and commissioning of the ore and coke recovery plant in December 1994 and by other operating efficiencies. • composition of residue solids (containing low level radionuclides) would be maintained. • the expansion does not involve construction of more storage areas at this time, but would reduce the life of the Dalyellup disposal site from 10 years to about 5 years. • potential uses currently being investigated for the residue include road base, brick manufacture, soil conditioner and nutrient adsorption. • a State Government task force is investigating alternative disposal site. • results of groundwater and radiation monitoring to date indicate no contamination. **Proponent's commitments:** • continue to monitor and audit the residue storage area at Dalyellup in accordance with the approved RMP and EMP. • continue to investigate options for waste minimisation and beneficial uses for solid residue. • continue to liaise with the State Government task force to establish disposal options and sites.	Having particular regard to: • the statutory requirements relating to the management of the radioactive wastes; • acceptable groundwater quality standards; and • the proponent's commitment to continue to manage the solid residue in accordance with statutory requirements, and to investigating options for the long-term management of the solid residue, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable
Groundwater quality	Plant site and area down hydraulic gradient from the site.	• Groundwater quality is maintained. • Draft WA Guidelines for Fresh and Marine Waters (EPA Bulletin 711, 1993).	• a network of monitoring bores is in place to detect any changes to groundwater beneath the site. • stormwater runoff and spillages will continue to be collected and directed to the wastewater treatment plant. • flow differential instrument located on the current pipeline will also be installed on future pipeline, to detect leakages. **Proponent's commitments:** • continue to control surface run-off from the plant site, to prevent groundwater contamination.	Having particular regard to: • the proponent's current management practice to prevent contamination of groundwater; and • the proponent's commitment and proposed management to prevent groundwater contamination, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable

Water resources	Kemerton industrial Park and surrounding area.	Sustainable use of water resources through recycling and waste minimisation.	• quarterly water level measurements and quality analysis, and annual review of groundwater status will continue. • expanded plant will incorporate water-saving technologies to reduce consumption per tonne of pigment, such as reuse of the finishing plant effluent and utilisation of closed cooling water loop (saving 65m3/h water), recycling of recovered water to Cockburn Cement (saving 19m3/h water). • water required to produce each tonne of finished pigment will be reduced from 41 tonnes to 32 tonnes (compared with 120-140 tonnes of water in other similar chloride process plants worldwide). **Proponent's commitments:** • continue to explore opportunities to further recycle and reuse process water. • if the water supply for the expansion is not provided by Water Corp, submit a detailed groundwater supply proposal for the expansion, to the DEP/EPA for assessment, prior to commissioning of the expanded plant.	Having particular regard to: • the proponent's current and proposed management practice to reduce water consumption; and • the proponent's commitment to continue to explore opportunities to further recycle and reuse water, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable
Public safety.	Kemerton industrial Park and surrounding area, including nearby residences.	Offsite risk should be minimised and managed in accordance with the EPA interim Guidance No.2 - "Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plants" (July 1998).	• risks and hazards on existing plant are managed by a THCP. • independent risk assessment indicates that individual risk and societal risk levels for the expansion meet the EPA criteria and published guidelines respectively. • Combined risk contours from both SCM and Nufarm expansions also meet acceptable criteria. **Proponent's commitments:** • minimise risks through implementation of risk mitigation measures. • prepare and implement a construction safety management plan and procedures, before commencement of the construction phase. • develop a Safety Report for the expanded plant, which will include a full QRA, to the satisfaction of DME, before commissioning of the expansion. • undertake technical and hazard reviews at all significant process changes.	Having particular regard to: • the proponent's commitments to manage hazards and risk levels to meet the EPA's risk criteria and risk minimisation principle, during the construction, commissioning and operation; • the requirements of the EPA's criteria for individual fatality risk off-site, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives provided that the proponent's commitments are made legally enforceable

The CER (Tables 7.1 and 7.2) provides information on the proposed emission limits from the process stack for various gases during thermal converter operation and the corresponding predicted ground level concentrations at the nearest residence. Additional information on the predicted impacts of air emissions and when by-passing the thermal converter was provided during the assessment of the expansion (MIC,1998).

The thermal converter would be designed to handle all possible start-up, normal running, upset and shutdown combinations. The thermal converter would be taken off line while the process is being optimised and during regular maintenance. When the thermal converter is off line, process gases would continue to be water scrubbed and vented via the main process stack. Emissions would then include carbon monoxide, carbonyl sulphide, and small amounts of sulphur dioxide and hydrogen sulphide.

All fugitive emissions collected by the suction vent system would be scrubbed and released to the atmosphere via the existing 66m stack currently used to discharge process gas to the atmosphere from the existing plant.

Design of the proposed emergency pressure release systems would be based on the existing plant design. The plant would operate at 30% of the bursting disc pressure. The pressure release systems would vent to emergency relief stacks which would be sized to ensure the appropriate design ground level concentrations are not exceeded.

The expansion would result in 20% increase in sulphur dioxide emission, 140% increase in oxides of nitrogen and small to no increases in other gaseous emissions such as chlorine, hydrochloric acid (from decomposition of $TiCl_4$), carbonyl sulphide and hydrogen sulphide. There would be a 46% decrease in carbon monoxide emission, as a result of the thermal converter system.

The main potential source of dust from the proposed expanded plant would be from the finishing section, where dust generation could occur once the pigment is dried. The finishing plant would be serviced by a dust collection system. This would comprise a baghouse, a vacuum fan and a substantial vacuum reticulation system. Pigment would be air conveyed between processing stages and collected in bag filters that would be vented to the atmosphere through a duct at or near ground level. Exhaust gases from the finishing plant driers would be filtered through bag filters before being discharged through the stack. Rotary air valves would also be vented through filter socks. Steam micronising exhaust would be vented through a condenser and closed circuit cooling tower loop. Bagging machines would be fully automatic low dusting machines.

Bag filter collectors would be fitted with overpressure interlocks that automatically shut down the pigment conveying system prior to venting. Emissions from the cooling towers would be monitored by regular visual inspections of cooling water colour to identify if filter socks are leaking pigment. The maximum design emission from the bag filters would be 100 mg/m^3 (at 0°C and 1 atmosphere) which represents 40% of the 250 mg/m^3 recommended in national guidelines for control of emissions of particulate air pollutants from new stationary sources (Australian Environment Council/National Health and Medical Research Council, 1985). Actual dust emissions are likely to be much lower.

The current DEP licence conditions for the plant stipulate emission limits for carbon monoxide, acid gases, chlorine, and hydrogen sulphide.

Submissions

More detailed information was sought on gaseous emissions and their predicted impacts, particularly under thermal converter by-pass condition. Detailed information was requested on air pollution control equipment and management of dust and other fugitive emissions. It was considered that the EPA's assessment should stipulate minimum standards for gaseous emissions, and should require monitoring for compliance.

Assessment

The area considered for assessment of this relevant environmental factor is the Kemerton Industrial Park and surrounding area, including nearby residences (Figure 5).

The EPA's objective in regard to this environmental factor is to ensure that:

- best practice measures are taken to minimise air discharges;
- air emissions meet the current air quality standards and emission limits; and
- emissions do not adversely affect the environment or health, welfare and amenity of nearby land users.

The DEP is currently developing a State-wide Environmental Protection Policy for air quality in Western Australia, which will implement the National Environmental Protection Measures standards for air quality management. For this expansion, the following air quality standards and emission limits are used as an evaluation framework:

- National Environmental Protection Measures (NEPM) (NEPC, 1998) air quality standards of 0.2 ppm (1hour average) for sulphur dioxide, 9 ppm (8 hour average) for carbon monoxide and 50ug/m^3 (1 day average) for PM10 particles;
- design ground level concentrations for intermittent discharge of chlorine (3-minute average) not exceeding 0.1ppm outside the Kemerton Industrial Park and 0.5 ppm within the Kemerton Industrial Park (EPA, 1997);
- the Australian Environment Council/National Health and Medical Research Council (AEC/NHMRC, 1986) guidelines for oxides of nitrogen of 350 mg/m^3 as an emission limit and 320 ug/m^3 or 0.16 ppm (one hour average ground level concentration not to be exceeded more than once per month) at the most affected residence;
- the DEP's draft design ground level concentrations (DEP, 1997) of 0.0007ppm for hydrogen sulphide, to prevent odours (EPA, 1997); and
- acceptable ground level concentration of 0.4mg/m^3 or 0.17ppm for carbonyl sulphide (to protect adverse health effects).

The EPA considers that the installation of a gas scrubbing train, a thermal converter system and a caustic scrubber would minimise stack emissions of particulates, odours and process gases. The predicted ground level concentrations of these emissions, using Maxmod air dispersion modelling, would also meet the acceptable air quality standards at the nearest residence (3.3km west of the plant) under thermal converter by-pass condition (a conservative allowance of 25% down-time has been made for maintenance and modifications of the thermal converter system).

The EPA notes that with the exception of oxides of nitrogen, which increases proportionally with the expansion production rate, other gaseous emissions per tonne of pigment for the expansion are lower than those for the current production rate.

Millennium has made commitments to minimise air emissions, by installing the integrated thermal converter system, a scrubber system capable of removing 95% of sulphur dioxide emissions and providing an adequate design of the new process stack. In addition, emergency stacks would be appropriately sized to ensure acceptable ground level concentrations and impacts at the nearest affected residence.

The EPA notes that there has been a decreasing trend in the frequency and severity of unplanned toxic gas releases releases since 1994 (MIC, 1998). Although the rate of occurrence of chlorine and $TiCl_4$ fugitive emissions could be expected to increase as a result of the plant expansion, this can be managed through equipment design and operational procedures.

The EPA notes that dust control from the finishing section, where there is a potential for dust generation, would be achieved through appropriate building design and equipment specifications. In addition, the maximum design emission from the bag filters would be 100

mg/m^3, which is 40% of the AEC/NHMRC recommended emission limit. It is considered that the dust emissions from the expansion would not be likely to exceed the NEPM standard outside the Kemerton Industrial Park boundary.

Having particular regard to:

(a) the acceptable air quality standards and limits applicable to this expansion; and

(b) the proponent's commitments and proposed management to minimise air emissions,

it is the EPA's opinion that air emissions associated with the expansion can be managed to meet the EPA's objectives for air emissions.

3.3 Greenhouse gases

Description

Gas burned for heating or steam generation and process gases burned in the thermal converter would generate carbon dioxide, water vapour, oxides of nitrogen and sulphur oxides which are greenhouse gases. Amongst these, carbon dioxide is a major greenhouse gas. About 194,000 tpa of CO_2 would be produced from the expanded plant. This represents a 177% increase in CO_2 emissions. This increase is slightly more than the production capacity increase (147%) (Table 2).

The CER states that greenhouse gas emissions would be managed according to a greenhouse gas control strategy. This strategy aims to improve energy efficiency and minimise the net generation of greenhouse gases, as follows:

- Greenhouse gas emissions would be minimised by using fuels with low greenhouse gas emissions. Carbon dioxide would be further reduced by reusing the heat generated from the thermal converter in the waste heat boiler in the process.
- Release of sulphur oxides would be minimised by removing it in scrubbers.
- Generation of nitrogen oxides would be minimised through the use of high efficiency, low nitrogen oxide-emission burners.
- Other greenhouse gases such as halons and CFCs would be phased out and a tree planting programme utilising native species grown in the company nursery would be initiated.

Submissions

Millennium should predict current and projected greenhouse gas emissions and put forward a plan to reduce them, and should be encouraged to join the Greenhouse Challenge programme.

Assessment

The area considered for assessment of this relevant environmental factor is the global environment.

The EPA's objective in regard to this environmental factor is to ensure that greenhouse gas emissions are minimised in accordance with the EPA interim Guidance No.12 - "Minimising Greenhouse Gas Emissions" (June 1998).

It should be mentioned that with the release of the National Greenhouse Strategy on 26 November 1998, the national position has progressed beyond Greenhouse Challenge. Effectively it has shifted from a "no regrets" (15% reduction from business as usual) to "beyond no regrets" (10% reduction from "no regrets"). Therefore it would be appropriate for the EPA to consider a revision to its greenhouse policy, to maintain consistency with the national approaches.

For this proposal, the EPA notes that there would be an increase in the overall CO_2 emissions associated with the expansion, from the current 70,000 tpa to 194,000 tpa of CO_2, primarily as a result of the operation of the thermal converter. However, the EPA considers that the expanded pigment plant is a small greenhouse gas emitter (less than 0.02% of the total emissions in Australia), and that Millennium's proposed management and commitments to minimise greenhouse gas emissions, such as entering the voluntary "Greenhouse Challenge" programme and using efficient technology, are appropriate.

Having particular regard to:

(a) the requirements of the EPA interim Guidance No.12 - "Minimising Greenhouse Gas Emissions" (June 1998);

(b) the proponent's proposed management to reduce emissions of greenhouse gases, in terms of improve energy efficiency in the process;

(c) the proponent's commitments on greenhouse gas emissions; and

(d) the expanded pigment being a small greenhouse gas emitter,

it is the EPA's opinion that emissions of the above gases can be managed to meet the EPA's objective for this factor.

3.4 Noise

Description

There has not been a noise problem associated with the operations of the pigment plant to date. The nearest residence is located about 3.3 km west of the plant. Existing plant noise emissions meet the *Environmental Protection (Noise) Regulations 1997*.

Predicted noise levels (Engineering Dynamics, 1997 and 1998) for the expansion are outlined in the CER. The total predicted sound power level from the expanded plant, including the finishing plant is expected to increase by approximately 7 dB(A) to 123 dB(A). The predicted noise levels for the expansion indicate compliance with the assigned noise levels in the Noise Regulations, apart from at the southern boundary of the plant site.

Submissions

More information is required on noise modelling to demonstrate that noise emissions comply with the assigned noise levels, and that the expanded plant is not a significant noise contributor.

Assessment

The area considered for assessment of this relevant environmental factor is the Kemerton Industrial Park and surrounding areas including nearby residences. This is the area within which noise levels must be controlled to meet statutory requirements and acceptable standards.

The EPA's objective in regard to this environmental factor is to ensure that noise emissions from the plant operations comply with the assigned levels in the *Environmental Protection (Noise) Regulations 1997.*

The DEP notes that the noise predictions are based on measurements of existing plant and use a well accepted noise prediction method (using Environmental Noise Modelling software, ENM) to compute noise levels from the expanded plant. Hence, these results are accepted as representative of the overall impact of the proposal.

The EPA notes that while the predicted noise levels for the expansion comply with the assigned noise levels in the Noise Regulations, the predicted noise level of 69 dB(A) at the southern boundary exceeds the regulations by 4 dB(A) due to the levels from some water pumps. The DEP has advised that compliance at the boundary should be achievable by relocating and/or applying noise control to the water pumps.

The DEP considers that as the noise predictions are based upon a physical duplication of the existing plant, in practice, with appropriate equipment choice and plant layout, the assigned levels under the Noise regulations could be complied with.

Although the EPA notes that the expanded plant would not be a significant noise contributor in Kemerton Industrial Park, the EPA understands that the sound power level of 123 dB(A) for the expanded plant could be critical in determining what noise levels new industries locating in the Kemerton Industrial Park could produce. It would be prudent for the Kemerton Advisory Board to further investigate the implications and restrictions that the expanded plant producing a sound power level of 123 dB(A) may cause.

Having particular regard to:

(a) the requirements of the *Environmental Protection (Noise) Regulations 1997*; and

(b) the proponent's commitments to meet the *Environmental Protection (Noise) Regulations 1997*,

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

3.5 Marine discharge

Description

Treated wastewater from the expanded plant would be discharged into the ocean, offshore from the Leschenault Peninsula. Between Kemerton and the ocean, the pipeline route traverses cleared private property and road reserves situated along Marriott Road, the Perth–Bunbury Highway and Buffalo Road, as shown in Figure 5.

The area around the outfall consists of a gently sloping sea bed. The depth of water increases gradually to reach a depth of 10 metres approximately 700 metres offshore, and a depth of about 20 metres, approximately 6 kilometres offshore. The seabed then remains relatively flat up to the edge of the continental shelf, which is approximately 90 kilometres offshore. There are no well developed reefs in the immediate vicinity of the proposed outfall, although isolated limestone outcrops occur up to 750 metres offshore.

This section of coast line is classified as "high energy" coastline where the full force of the ocean swell reaches the shoreline because there are no seaward reefs to act as barriers. Due to this high energy, the sands along the coastline continually shift and turbidity in the water column is high.

Most of the reef areas, and seagrass and algal meadows in the area offshore from the Leschenault Peninsula, are relatively low in both species composition and abundance (Meagher and LeProvost 1975).

Wastewater would be generated from a number of sources including sand filter backwash water, water for scrubbing exit gases, regeneration and rinse waters from ion exchange water softening and demineralisation, pigment washing, the Nufarm chlor-alkali plant (which supplies chlorine to the plant), the BOC air separation plant (which supplies nitrogen and oxygen) and the Cockburn Cement lime plant.

The expansion would result in a considerable increase in wastewater discharge (216% increase), primarily as a result of the new pigment finishing process. To accommodate this increase, the process water treatment system would be upgraded and would include a new wastewater treatment plant to handle wastes arising from the finishing plant, and a new saline water pond with three times the capacity of the existing ponds. A diagram describing the current process water treatment system is presented in Figure 6. The effluent would be neutralised, clarified and then piped to saline water holding ponds prior to ocean disposal.

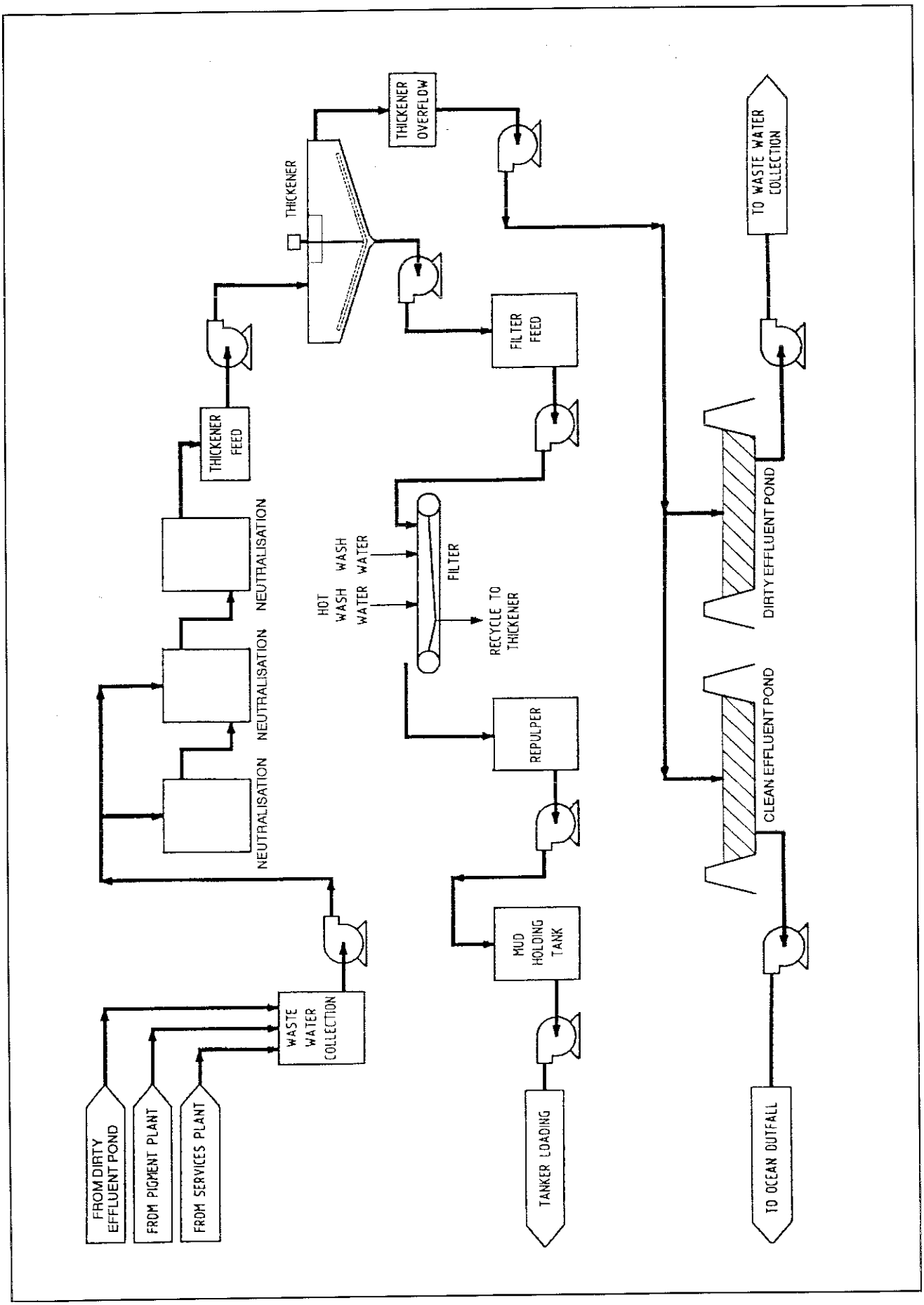

Figure 6. Existing water treatment process.

The rate of disposal to the ocean outfall would increase from 110 m^3/hr to 376 m^3/hr. To cater for this increase, the pipeline and diffuser would be upgraded. This may involve installing a new larger pipeline and diffuser, or a second pipeline separately . The route of the proposed pipeline would follow the existing pipeline route, as shown in Figure 5.

The ultimate design of the ocean outfall would ensure adequate mixing of the saline water with the sea water occurs within 20 m of the discharge point and the resultant water quality complies with water quality criteria specified in EPA Bulletin 711 (EPA, 1993). Table 7.3 of the CER, which shows the likely composition of the treated saline water from the plant, both before and after mixing with sea water, indicate that the chemical composition following dilution would fall within the limits specified by the EPA for the protection of aquatic ecosystems and human consumers of fish and other aquatic organisms.

The current DEP licence conditions for the plant stipulate effluent discharge limits for temperature, suspended and dissolved solids, pH, chromium, iron, manganese, vanadium and radionuclides (radium 226, radium 228 and thorium 228), and monitoring requirements for water quality and sediments surrounding the outfall.

Under the *Radiation Safety Act 1975* and Regulations, the Radiological Council also requires monitoring of radionuclides in the effluent discharge. Current monitoring indicates uranium and thorium would not be detectable in the treated saline water and radionuclide levels in the receiving ocean water would be within normal environmental levels. Recent monitoring of the sediments around the ocean outfall indicates that trace radionuclides are present at detection limits. While there are naturally occurring patches of mineral sands in the area, the source of these trace radionuclide levels has not been determined and investigation is continuing.

Submissions

More information was requested on the mixing zone and the potential impacts of the discharge on the receiving environment, including water, sediment and biota quality outside the mixing zone. The DEP believes that the proponent should commit to discharge its wastewater via the proposed single pipeline for the discharge of Kemerton Industrial Park to ocean. Other concerns include the impacts of increase in wastewater discharge volume on the ocean environment and the need to remove radionuclides and toxic substances before any ocean discharge.

Assessment

The area considered for assessment of this relevant environmental factor is the plant site, the end of the effluent discharge pipelines and diffuser, and the marine environment outside the boundary of the mixing zone of the diffuser. A mixing zone of about 12,000 m^3 (20 metres from diffuser, 10 metres deep) has been estimated around the proposed diffuser, which will be designed for a total flow rate of 376 m^3/hr. Effluent quality must be managed to meet discharge limits and acceptable standards outside the boundary of the mixing zone.

The EPA's objective in regard to this environmental factor is to ensure that marine water quality is maintained or improved and, where possible, impacts upon locally significant marine flora and fauna communities are avoided, by ensuring that the effluent quality and water quality in the vicinity of the defined mixing zone comply with the following statutory and acceptable standards:

- the *Radiation Safety Act 1975* and the *Radiation Safety (General) Regulations 1983*;
- the DEP's licence limits for effluent discharge; and
- acceptable standards including the Draft WA Water Quality Guidelines for Fresh and Marine Waters (EPA, 1993b) and the Draft Environmental Quality Criteria (EQC) and Objectives (EQOs) recommended in the Southern Metropolitan Coastal Waters Study (1991-1994) report (DEP, 1996).

The EPA notes that although the effluent flow rate for the expansion will be considerably increased (261%), the likely concentrations of effluent discharge from the expansion would comply with the licence limits and would meet the Radiological Council's requirements for radionuclides. The predicted concentrations outside the mixing zone would also meet the recommended water quality guidelines for the protection of aquatic ecosystems and human consumers of fish and other aquatic organisms.

The DEP advised that Millennium has recently undertaken a review of the current monitoring and as a result, has revised the future monitoring programme. The revised monitoring proposal is designed to test the hypotheses that there will be no significant change in relation to water, sediment and biota quality outside the mixing zone and is supported by the DEP. The revised monitoring allows for statistical analysis for "direction" and "distance" of potential changes in water and sediment quality, and meaningful statistical analysis of biota monitoring, by including additional sediment sampling stations (at 75m and 1,000m north and south of the outlet) and biomonitoring at a low frequency (eg once every three years) to complement benthic invertebrate sampling (Kinhill, 1998). The DEP considers that the revised monitoring programme, together with the results of the last ten years of monitoring would provide a basis to assess the potential impacts of the expansion.

The EPA notes that Millennium has committed to take appropriate action including appropriate design and operation of the wastewater treatment and ocean outfall diffusion systems, investigation and monitoring of the receiving environment and corrective measures, if problems are detected. Millennium has also committed to submit a detailed wastewater disposal system proposal for the expansion to the DEP/EPA for assessment prior to commissioning of the expanded plant, if the waste water disposal system is not provided by the Water Corporation, and to continue to implement the Radiation Management Plan (RMP) approved by the Radiological Council, and audit its effectiveness.

Having particular regard to:

(a) the proponent's proposed management and commitments to take appropriate action to ensure no significant change in relation to water, sediment and biota quality outside the mixing zone, as a result of the expansion;

(b) the requirements of the DEP's licence conditions and the *Radiation Safety Act 1975* and the *Radiation Safety (General) Regulations 1983*, administered by the Radiological Council; and

(c) acceptable marine water quality standards, including the Draft environmental quality criteria recommended in the Southern Metropolitan Coastal Waters Study (1991-1994) report.

it is the EPA's opinion that the expansion proposal can be managed to meet the EPA's objective for marine discharge.

3.6 Solid residue

Description

About 397,000 tpa of solid residue (a slurry containing 11-15% solids at a pH of 8 to 10) would be produced from the expansion, mainly from the wastewater treatment process. This represents an increase of 182%. The solid residue would consist mainly of unreacted ore and coke, and metal hydroxides from the raw pigment process. It also contains small quantities of radioactive elements (about 33ppm uranium and 400ppm thorium), resulting from the concentration of the low levels of radionuclides present in the synthetic rutile feedstock. The radioactivity of the solid residue is low and would not be classified as a radioactive substance under the Transport Code. Table 7.5 of the CER shows the composition of a typical solid residue. Figure 7.1 of the CER shows the radiation flow paths.

The solid residue would continue to be transported by road tanker to the existing solid residue storage area at Dalyellup, south of Bunbury for disposal. The number of tanker loads would increase from an average of ten to twenty four each day. The Dalyellup site is located within the

buffer zone of the Bunbury sewage treatment plant, and is operated under approvals by the Radiological Council of Western Australia and the DEP.

At Dalyellup, the slurry would be discharged into the disposal pond to allow the solids to separate from the water. Progressive dewatering of the solids would occur through evaporation and seepage. The downward seepage of pore water contained within the residue would infiltrate the unsaturated zone of the superficial formation.

The CER states that during this process, leachate constituents would chemically interact with a range of soil materials. Research and site monitoring results indicate that trace levels of soluble heavy metals in the slurry water leachate are immobilised or attenuated within the soil layer, most likely as a consequence of the alkaline nature of the solid residue and the alkalinity of the underlying soils, both of which reduce the solubility of the heavy metal elements. Millennium would continue to use this natural buffering by ensuring management procedures maintain the alkalinity of the residue.

Leachate passing through the soil layer would be mixed and diluted by groundwater as it flowed toward the ocean and was mixed at the interface with the seawater. Water infiltrating from the residue to the underlaying soil profile would have a slightly elevated salinity level in comparison to the up gradient, natural groundwater.

Under current production rates, the existing areas would be full within ten years. The expanded production rates would reduce the life of the Dalyellup disposal site, since the expansion does not involve construction of any more storage areas at this time.

Following decommissioning, the site would be rehabilitated either to native vegetation or to turf-based recreational facilities. Rehabilitation studies and trials have already been undertaken, and show the site can be rehabilitated successfully.

Millennium has been investigating options for the long-term management of the solid residue produced by the plant, including research into possible uses for the solid residue, residue minimisation, recycling and alternative methods of disposal.

Millennium would continue monitoring and undertaking environmental audits at the solid residue storage area at Dalyellup in accordance with their Environmental Management Plan and the Radiation Management Plan, to the satisfaction of the DEP.

Submissions

Details on solid waste minimisation programme were requested and the increase in solid residue would require a satisfactory long term management strategy.

Assessment

The area considered for assessment of this relevant environmental factor is the residue transport route and the Dalyellup disposal site.

The EPA's objective in regard to this environmental factor is to ensure that generation of solid residue is minimised and solid residue is transported and disposed of in an acceptable manner to avoid potential contamination of soil, surface water and groundwater, and to keep radiological impacts as low as reasonably achievable, by:

- complying with statutory requirements including the DEP's licence conditions, the *Radiation Safety Act 1975*, *Radiation Safety (General) Regulations 1983, and Radiation Safety (Transport of Radioactive Substances) Regulations 1991* (administered by the Radiological Council); and
- meeting acceptable environmental quality standards including the Draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).

The EPA notes that whilst the quantity of the solid residue will be increased with the expansion, its composition and the quality of slurry water would be maintained. The current management of radionuclide containing wastes, which complies with the statutory requirements of the Radiological Council, will continue for the expansion.

The EPA notes that ongoing monitoring of current disposal practice indicates that no adverse environmental impacts are likely to occur from the disposal of solid residue at the Dalyellup site (Dames & Moore, 1998).

Monitoring of the groundwater surrounding the Dalyellup site indicates that previous disposal has resulted in the formation of a brackish plume beneath and down gradient of the active ponds. The brackish water, following mixing and dilution with the westward moving groundwater, discharges across the saline interface to the ocean. Since the quality of slurry water would remain the same, the quality of the groundwater at the disposal site is expected to remain within the current parameters with only minor fluctuations occurring down gradient of the active ponds. Groundwater metal levels are similar to background levels, most likely due to the alkaline nature of the solid residue.

Radiation monitoring is undertaken in accordance with the Radiation Management Plan and the results confirm that there are no concerns regarding radiation exposure or radioactive contamination associated with residue disposal at Dalyellup.

The EPA notes that, as part of a long term management strategy for the residue disposal, Millennium has been carrying out investigation on alternative uses for the residue, which include road base, brick manufacture, soil conditioner and nutrient adsorption. Studies are being undertaken to determine methods to reduce radioactive levels in the feedstock and in the corresponding residue, to allow a wider use of the residue.

In addition to research into possible uses for the solid residue, Millennium is committed to continuing its research into residue minimisation, recycling and alternative methods of disposal. A reduction in solid waste output by 40% was achieved in 1994, through the ore and coke recovery plant and by other operating efficiencies.

A State Government task force (consisting of representatives from the Department of Resources Development, LandCorp and the DEP Office of Waste Management) is investigating alternative disposal sites.

Having particular regard to:

(a) the statutory requirements of the Radiological Council relating to the management of the radioactive wastes;

(b) acceptable groundwater quality standards including the Draft WA Guidelines for Fresh and Marine Waters (EPA, 1993); and

(c) the proponent's commitment to continue to manage the solid residue in accordance with the requirements of the Radiological Council and DEP, and to investigating options for the long-term management of the solid residue produced by the plant, including research into possible uses for the solid residue, residue minimisation, recycling and alternative methods of disposal,

it is the EPA's opinion that the expansion proposal can be managed to meet the EPA's objectives for solid residue.

3.7 Groundwater quality

Description

A groundwater divide, aligned north-east to south-west and consistent with the alignment of the eastern ridge, occurs to the west of the Millennium plant site at Kemerton. On the western side of the divide, groundwater flows west towards the Leschenault Estuary and the sea, some of it via the western Kemerton wetlands. To the east of the site, groundwater flows towards the Wellesley River. Groundwater beneath the current and proposed site flows in a south-westerly direction.

The existing Kemerton plant was designed to protect the groundwater system. Possible spillage areas have been sealed and bunded, and a network of monitoring bores are in place to detect any changes to the groundwater beneath the site. Minor spillages have been successfully contained,

and the clean-up programmes have prevented any measurable effect on the groundwater system from these incidents.

For the expansion, all process plant areas would be sealed using concrete or bitumen. Stormwater and runoff from within the process plant would be contained, collected and pumped to the neutralisation plant for treatment. Some of this water would be recycled within the process.

All underground tanks (for storage of a hydrocarbon) have been installed with cathodic protection to minimise deterioration of the tank shell. All above ground tanks (for storage of hydrogen peroxide, hydrochloric acid, titanium tetrachloride, sodium hydroxide, diesel and hydrocarbon) stand within bunded cells which are capable of holding the total capacity of the tank, should it rupture or spill. The contents of the bund would be directed, via drains, to the neutralisation plant, which is designed to handle and treat any spills.

Stormwater and surface runoff from hardstand areas, such as car parks and roads, outside the process plant areas would be collected through a series of covered drains, and directed to low-lying areas where stormwater basins and ponds would be constructed.

As part of the DEP licence conditions, quarterly water level measurements and quality analysis, and an annual review of groundwater status, are undertaken and reported. Monitoring results indicate that operation of the raw pigment plant is having little or no effect on the groundwater system beneath the plant site. The quality remains similar to that in 1989, when monitoring commenced, and groundwater levels remain unchanged, apart from the expected seasonal fluctuations.

Submissions

Concerns were expressed about the potential increase in contamination threat to groundwater from the expansion. Details of monitoring programmes and safeguards to ensure early leak detection should be provided. Since the ocean pipeline carries large volume of saline water and traverses sensitive groundwater areas, monitoring of the pipeline is required for early detection of pipe breakages.

Assessment

The area considered for assessment of this relevant environmental factor is the groundwater beneath the site and down-gradient of the site. This is the area where groundwater quality could be affected by the operations of the pigment plant, which subsequently could impact the water quality of the Leschenault Estuary.

The EPA's objective in regard to this environmental factor is to ensure that groundwater quality is maintained and meet acceptable standards including the Draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).

The EPA notes that for the expansion, stormwater and runoff from within the process plant would be contained, collected and pumped to the neutralisation plant for treatment. Storage of all dangerous goods would meet statutory requirements (by the Department of Minerals and Energy and the DEP) and relevant standards, in regard to tank integrity and spillage containment.

The EPA notes that the current groundwater monitoring bore network would be expanded to ensure timely detection of any changes to the groundwater beneath the site.

The results of groundwater monitoring to date indicate that the groundwater quality remains similar to that of 1989 when the monitoring commenced.

The EPA also notes that the flow differential instrumentation located on the current saline water pipeline would be installed as part of any future pipeline, to allow detection of pipe breakages.

Millennium has committed to continue to control surface run-off from the plant site, to prevent groundwater contamination.

Having particular regard to:

(a) the proponent's current management practice to prevent contamination of groundwater; and

(b) the proponent's commitment and proposed management to prevent groundwater contamination,

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

3.8 Water Resources

Description

The regional groundwater consists of three deep semi-confined aquifers (within the Leederville, Cockleshell Gully and Yarragadee Formations) and an unconfined surface aquifer (within Bassendean and Karrakatta sands). The deep aquifers provide for agriculture and industrial uses and the surface aquifer, extracted by low-yield bores, for irrigation.

The CER indicates that the shallow water table is 5–11m above sea level. The unconfined surface aquifer is fairly permeable with groundwater movement in the order of 50–100 m/year. The water table lies at an average depth of 2m during summer, and typically rises and falls according to the seasonal rainfall pattern.

The salinity of the surface aquifer is variable and ranges from 500–1,000 g/m^3. Leakage may occur between the surface aquifer and the semi-confined aquifers of the Leederville and Yarragadee Formations. The salinity of the Leederville Formation groundwater is approximately 1,000–1,200 g/m^3, with an increase, with depth, in the concentration of iron and other dissolved minerals. The salinity of the groundwater increases with depth.

The expansion of the plant and construction of a finishing plant would result in a considerable increase (233%) in water consumption. Presently water is obtained from three bores which extract water from sub-artesian aquifers. These bores would be unable to supply the demand from the expanded operations. Although the additional water could be sourced from deep groundwater, water supply for the expansion will be coordinated by the Water Corporation as part of an overall supply to Kemerton Industrial Park.

The expanded plant would incorporate water saving technologies, currently in use at the existing Kemerton and Australind plants, to reduce the consumption per tonne of pigment produced. Figure 7 describes the water balance and recycling proposal. Reuse of finishing plant effluent and utilisation of closed cooling water loops would save 65 m^3/hr. Recycling of recovered water to Cockburn Cement would save 19 m^3/hr.

These conservation measures would reduce the raw water usage from 40.9 to 31.9 tonnes per tonne of pigment produced. This compares favourably with the 120-140 tonnes per tonne of pigment used in other chloride process plants and the 200-400 tonnes per tonne of pigment used in sulphate process plants.

As mentioned earlier, groundwater monitoring results indicate that operation of the raw pigment plant is having little or no effect on the groundwater system beneath the plant site. The quality remains similar to that in 1989, when monitoring commenced, and groundwater levels remain unchanged, apart from the expected seasonal fluctuations.

Submissions

There is a concern that the existing plant is a large consumer of groundwater and thus water supply sources for the expansion should be defined. Millennium must develop a water management plan to reduce groundwater use by using other sources and by recycling of process waste.

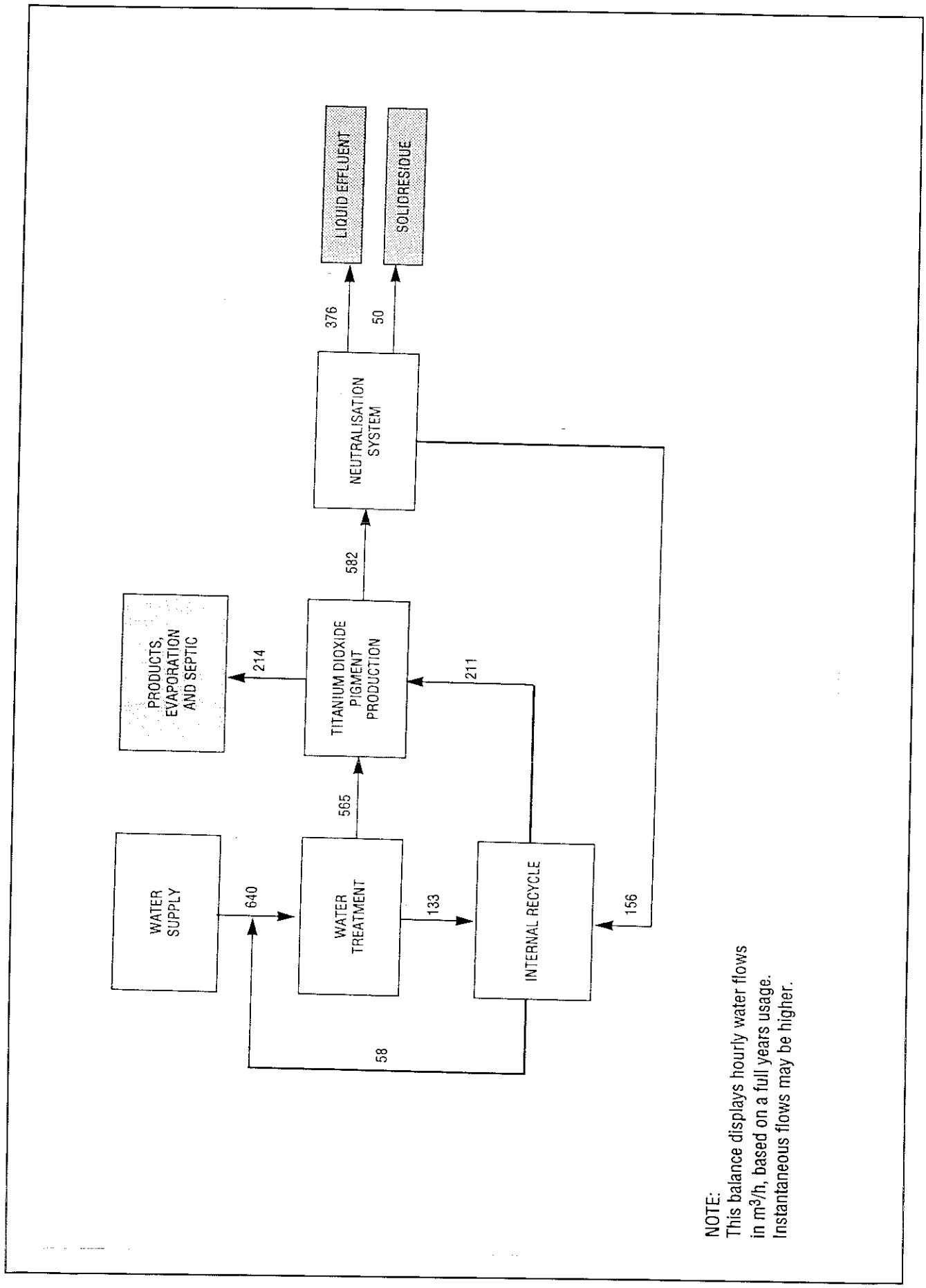

Figure 7. Water balance.

Assessment

The area considered for assessment of this relevant environmental factor is the Kemerton Industrial Park and surrounding area.

The EPA's objective in regard to this environmental factor is to ensure that there is sustainable use of water resources through recycling and waste minimisation.

The EPA notes that although the expansion would result in a considerable increase in water consumption, primarily due to the new finishing plant, the raw water usage will drop from 40.9 to 31.9 tonnes per tonne of pigment produced, as a result of the water-saving technologies. This is considerably less than the 120-140 tonnes per tonne of pigment used in other plants worldwide (CER, page 27).

The EPA also notes that water supply for the expansion will be coordinated by the Water Corporation, as part of an overall supply to the Kemerton Industrial Park. The Water Corporation advised that the previous proposal for water supply from the Collie river weir, which had been assessed by the EPA (EPA, 1994), is no longer a desirable option due to water quality concerns. The Water Corporation, in association with the Office of Water Regulations, is currently examining long term water servicing options for the Kemerton Industrial Park. Any further proposal for water supply to the park collectively or to the expansion, would need to be referred to the EPA for assessment.

Millennium has committed to continue to explore opportunities to further recycle and reuse process water. If the water supply for the expansion is not provided by Water Corp, Millennium will submit a detailed groundwater supply proposal for the expansion, to the EPA for assessment, prior to commissioning of the expansion.

Having particular regard to:

(a) the proponent's current and proposed management practice to reduce water consumption; and

(b) the proponent's commitment to continue to explore opportunities to further recycle and reuse water,

it is the EPA's opinion that the expansion proposal can be managed to meet the EPA's objectives for water resources.

3.9 Public safety

Description

The main hazards from the pigment plant with potential offsite impacts are associated with toxic releases of chlorine, hydrogen chloride and $TiCl_4$.

Hazards and risk on the existing plant are managed by a Safety Report (previously a Total Hazard Control Plan or THCP), developed in accordance with the National Standard and Control of Major Hazardous Facilities (NOHSC, 1996) and to meet the requirements of the Department of Minerals and Energy (DME). The DME has statutory responsibility for managing major hazard facilities in Western Australia in respect of public safety.

A Preliminary Risk Assessment (PRA) of the proposed expanded plant has been carried out independently and the results show that individual risk levels from the proposed expansion fall within the EPA criteria. As shown in Figures 8 and 9, the one-in-a-million risk contour for the proposed SCM plant and the neighbouring Nufarm chlor-alkali plant falls almost entirely within the SCM property boundary. The societal risk levels also meet acceptable criteria.

A full Quantitative Risk Assessment (QRA) will be undertaken when the detailed project design is completed. The Safety Report (or THCP) will be amended prior to commissioning to incorporate the proposed changes to the plant and meet the requirements of the DEP and DME.

Details of the independent risk assessment for the expansion are outlined in the PRA report (Stratex, 1996). A summary of this PRA is shown in Appendix E of the CER.

FIGURE 4. INDIVIDUAL RISK CONTOURS FOR THE SITE

(FATALITIES PER YEAR)

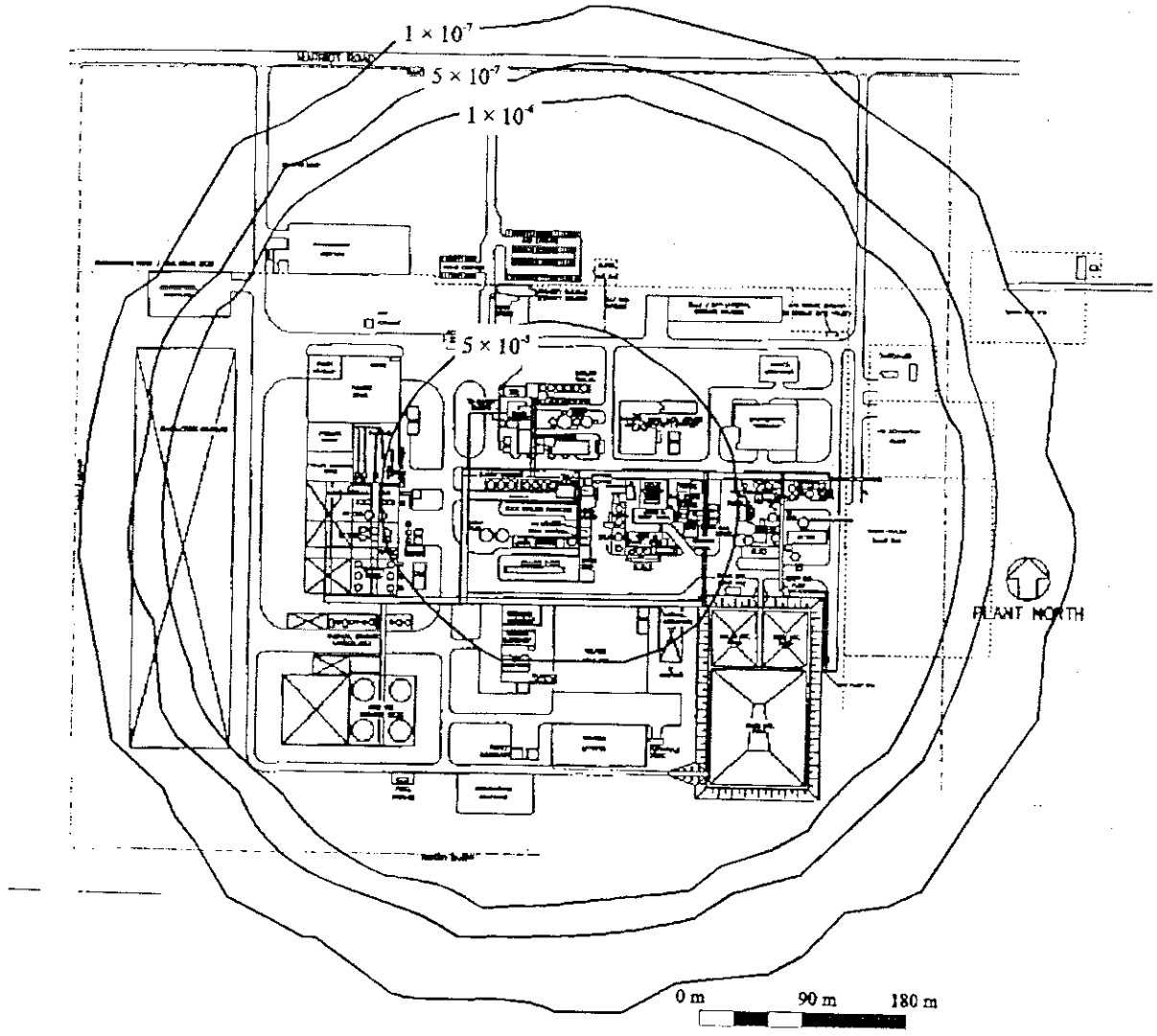

Figure 8. Risk contours for the expanded plant.

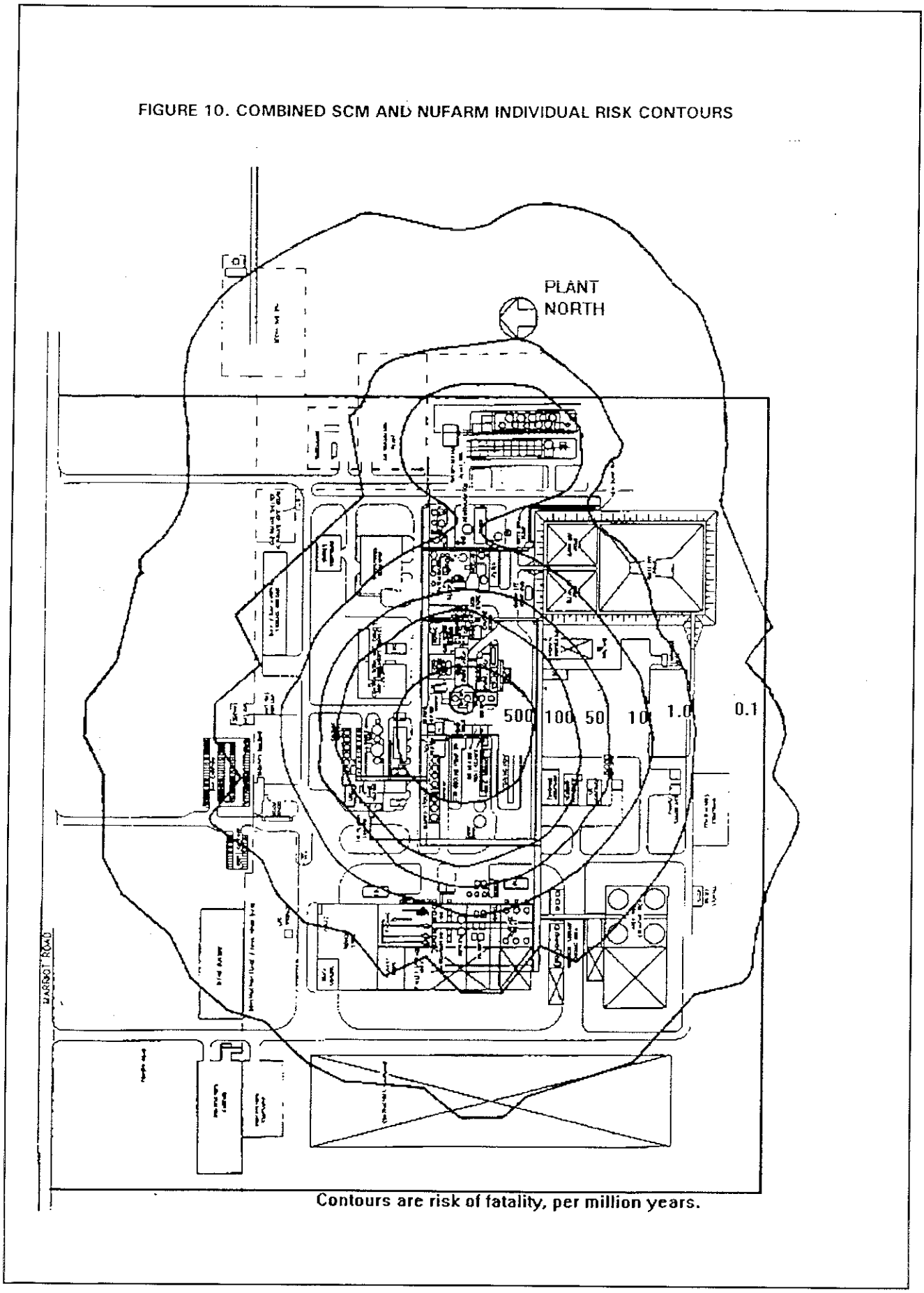

Figure 9. Combined risk contours for the expanded plant and Nufarm plant.

Submissions

No concern was expressed on risk and hazards associated with the expaned plant. Both the DME and DEP considered that the expansion would meet the EPA's individual risk criteria, and societal risk would not an issue.

Assessment

The area considered for assessment of this relevant environmental factor is the Kemerton Industrial Park and surrounding areas including nearby residences.

The EPA's objective in regard to this environmental factor is to ensure that risk is minimised and managed in accordance with the EPA interim Guidance No.2 - "Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plants" (July 1998). This Guidance consolidates the EPA's previous position on risk (EPA, 1992a and 1992b).

According to the EPA interim Guidance No.2, the acceptable criteria for off-site individual fatality risk are as follows:

(a) a risk of fatality of one in a million per year or less in residential zones;

(b) a risk of fatality between one half and one in a million per year in "sensitive developments", such as hospitals, schools, child care facilities and aged care housing developments;

(c) risk of fatality for industrial facilities not exceeding a target of fifty in a million per year at the site boundary for each individual industry, and the cumulative risk level imposed upon an industry not exceeding a target of fatality risk one hundred in a million per year; and

(d) a risk of fatality of ten in a million per year or lower for any non-industrial activity located in buffer zones between industrial facilities and residential zones.

Although the EPA has not yet established any criteria for societal risk, it recognises the need to develop these criteria in the near future.

The EPA has also established a risk management principle which stipulates that risks should be reduced to a practicable minimum.

As a result of its technical review of the QRA reports, the DME and the DEP consider that the method used to compute the risk contours is acceptable and that the EPA's individual risk criteria will be met at the plant fence line and at residential areas, for the expansion.

Combined risk contours for this expansion and Nufarm's expansion also meet the EPA's acceptable criteria, although the risk contour of 1E-7 (or 0.1 in a million per year) is increased by about 200m eastward.

The DEP considers that the societal risk levels for the expansion alone and for the Kemerton Industrial Park collectively, are low (due to the absence of people at Kemerton) and would be acceptable, in comparison with the societal risk guidelines suggested for the Kwinana industrial area (AEA, 1995) and other published/adopted guidelines.

The DEP advised that Millennium should be required to develop and implement a construction safety management plan and procedures to manage risk during the construction period, where construction activity is occurring around operating plant. Both the DEP and DME consider that Millennium should be required to review the Safety Report (or THCP) for the expanded plant before its commissioning.

The EPA notes Millennium's commitments to implement risk mitigation measures, including those cited in the PRA report, to further reduce the risk levels. Millennium has also committed to preparing and implementing a construction safety management plan and procedures, and revising the Safety Report for the expanded plant. These commitments are consistent with the EPA's risk minimisation principle and the requirements of the DEP and DME.

Having particular regard to:

(a) the proponent's commitments to manage hazards and risk levels to meet the EPA's risk criteria and risk minimisation principle, and the requirements of the DEP and DME in regard to managing public risk during the construction period and the Safety Report; and

(b) the requirements of the EPA's criteria for individual fatality risk off-site,

it is the EPA's opinion that the expansion proposal can be managed to meet the EPA's objective for public safety (risk).

4. Conditions

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of 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, and following discussion with the proponent the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are 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 that relating to the proponent's commitments.

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by Millennium Inorganic Chemicals to expand its existing titanium dioxide facility at Kemerton is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) in order to manage the environmental impacts of the proposal, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction of the expanded plant, the proponent shall demonstrate that the environmental management system in place includes the following elements:

- an environmental policy and corporate commitment to it;
- mechanisms and processes to ensure:
  - planning to meet environmental requirements;
  - implementation and operation of actions to meet environmental requirements;
  - measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes;

(c) in order to successfully carry out the decommissioning of the plant and rehabilitation of the site and its environs, the proponent shall prepare and implement a decommissioning and rehabilitation plan; and

(d) the proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

5. Conclusions

The EPA has considered the proposal by Millennium Inorganic Chemicals to expand its existing titanium dioxide facility at Kemerton. The EPA considers that the proposal can be managed to meet the EPA's objective and thus not impose an unacceptable impact on the environment, provided that the conditions recommended in Section 4 and set out in detail in Appendix 3, are imposed.

6. Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. 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 considers the report on the relevant environmental factors of air emissions, greenhouse gases, noise, marine discharge, solid residue, groundwater quality, water resources, and public safety, as set out in Section 3;

2. That the Minister notes that the EPA has concluded that the proposal can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment, provided there is satisfactory implementation by the proponent of the recommended conditions; and

3. That the Minister imposes the conditions and procedures consistent with Section 4 and set out in detail in Appendix 3 of this report.

Appendix 1

List of Submitters

List of organisations who made submissions

Organisations:

Water and Rivers Commission

Water Corporation

Department of Minerals and Energy

Conservation Council of Western Australia

Shire of Harvey

Appendix 2

References

AEA (1995) *Kwinana Industrial Area - Risk Analysis Update - Cumulative Risk Study.* Prepared for the Department of Minerals and Energy by AEA Technology, June 1995.

Dames & Moore (1998) *Groundwater Monitoring Review for the Dalyellup Residue Disposal Facility May 1997 to April/May 1998.* Prepared by Dames & Moore for Millennium Inorganic Chemicals, September 1998.

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Engineering Dynamics (1997) *Noise Prediction for the Kemerton Plant Expansion.* Prepared for SCM Chemicals by Engineering Dynamics Consultants Pty Ltd, Report 9637, March 1997.

Engineering Dynamics (1998) *Noise Prediction for the Kemerton Plant Expansion.* Prepared for SCM Chemicals by Engineering Dynamics Consultants Pty Ltd, Addendum to Report 9637, July 1998.

EPA (1987) Proposed Chloride Process Titanium Dioxide Plant at Kemerton. Environmental Protection Authority Bulletin 283, July 1987.

EPA (1991) *Proposed Use of existing SCM solid residue disposal site at Dalyellup, from March 1992 to March 1994.* Environmental Protection Authority Bulletin 589, October 1991.

EPA (1992a) *Criteria for the Assessment of Risk from Industry.* Environmental Protection Authority Bulletin 611, February 1992.

EPA (1992b) *Criteria for the Assessment of Risk from Industry - expanded discussion..* Environmental Protection Authority Bulletin 627, May 1992.

EPA (1993a) *Proposed to Continue Using the existing SCM solid residue disposal site at Dalyellup, beyond March 1994.* Environmental Protection Authority Bulletin 706, October 1993.

EPA (1993b) *Draft Western Australian Water Quality Guidelines for Fresh and Marine Waters.* Environmental Protection Authority Bulletin 711, October 1993.

EPA (1994) *Water Supply for Kemerton Industrial Park.* Environmental Protection Authority Bulletin 758, October 1994.

EPA (1997) *Staged Expansion of Tiwest Pigment Plant to 180,000tpa, Kwinana.* Environmental Protection Authority Bulletin 847, March 1997.

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NOHSC (1996) *National Standard (NOHSC:1014(1966)) and National Code of Practice (NOHSC:2016(1996)) for the Control of Major Hazard Facilities.* National Occupational Health and Safety Commission, September 1996.

Stratex Worley (1996). *Preliminary Risk Assessment of the Proposed Expansion of the SCM Chemicals, Kemerton Facility.* Prepared for SCM Chemicals by Stratex Worley Pty Ltd, December 1996 .

National Environment Protection Council (NEPC). 1998. *Draft National Environment Protection Measure for Ambient Air Quality* , August 1998.

Appendix 3

List of Recommended Ministerial Conditions and Proponent's Consolidated Commitments

Statement No.

RECOMMENDED CONDITIONS

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

EXPANSION OF EXISTING TITANIUM DIOXIDE PIGMENT FACILITY TO 195,000 TPA, KEMERTON INDUSTRIAL PARK

Proposal: Expansion of the existing titanium dioxide plant, to increase the plant production capacity from 79,000 tonne per annum (tpa) to 195,000 tpa of finished titanium dioxide pigment, at the Kemerton Industrial Park, within the Shire of Harvey, 140 km south of Perth, 17 km north-east of Bunbury and 4 km east of the Leschenault Estuary, as documented in schedule 1 of this statement.

Proponent: Millennium Inorganic Chemicals Ltd

Proponent Address: Australind

Assessment Number: 1006

Report of the Environmental Protection Authority: Bulletin 920

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where 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 substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where 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.

2 Proponent Commitments

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

2-2 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 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 construction of the expanded plant, the proponent shall demonstrate to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection that the environmental management system in place includes the following elements:

1 An environmental policy and corporate commitment to it;

2 Mechanisms and processes to ensure: -

(1) planning to meet environmental requirements;
(2) implementation and operation of actions to meet environmental requirements;
(3) measurement and evaluation of environmental performance; and

3 Review and improvement of environmental outcomes.

3-2 The proponent shall implement the environmental management system referred to in condition 3-1.

4 Decommissioning and Rehabilitation Management Plan

4-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning and Rehabilitation 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, retention of plant and infrastructure;

2 (final) rehabilitation of all disturbed areas to a standard suitable for agreed new land use / s; and

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

4-2 The proponent shall implement the Decommissioning and Rehabilitation Management Plan required by condition 4-1 until such time as the Minister for the Environment determines that decommissioning and / or rehabilitation is / are complete.

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

5 Performance Review

5-1 Each six years following the commencement of construction of the expanded plant, the proponent shall submit a Performance Review to the Department of Environmental Protection:

- to document the outcomes, beneficial or otherwise;
- to review the success of goals, objectives and targets; and

- to evaluate the environmental performance over the six years;

relevant to the following:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 920;

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/or

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.

6 Proponent

6-1 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.

6-2 Any request for the exercise of that power of the Minister referred to in condition 6-1 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.

6-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

7 Commencement

7-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

7-2 Where the proposal has not been substantially commenced within five / ten 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.

7-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 7-1 and 7-2.

7-4 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 five years for the substantial commencement of the proposal.

8 Compliance Auditing

8-1 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.

8-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal clearances.

8-3 Where compliance with any condition, procedure or commitment 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.

Schedule 1

PROPOSAL (1006)

The expansion proposal is to increase the nominal production capacity of the existing Kemerton/Australind operations from the current level of 79,000 tpa to 195,000 tpa of finished titanium dioxide, by modifying the existing titanium dioxide chloride process plant and establishing a new finishing plant (with a capacity to produce an additional 116,000 tpa of finished pigment) at Kemerton.

The existing titanium dioxide chloride process plant is located in the Kemerton Industrial Park (Figure 1).

The process used for the expanded facilities will be identical to the existing process, which is the chloride process. The chloride process can be separated into eight distinct sections, which are: ore handling (Unit 100), chlorination, purification (Unit 200), oxidation (Unit 300), Pre-finishing (Unit 400), gaseous effluent handling (Unit 500), effluent treatment (Unit 550) and utilities (Figure 2).

The new finishing plant includes pigment treatment and vacuum filters, driers, pigment mills and packaging equipment (Figure 3).

The location of the expanded plant is shown in Figure 4.

Extra chlorine, compressed nitrogen and oxygen will be required, through either replacement of the existing pipelines or installation of additional pipelines.

In addition to its own process water, the expanded plant will continue to accept wastewater from other sources (the chlor-alkali plant, air separation plant and lime plant) for treatment and subsequent ocean disposal via pipeline (Figure 5).

Components of the expanded plant are shown in Table 1. Estimated inputs and outputs for the expansion, in comparison with the existing plant, are shown in Table 2.

PROPOSAL TABLES AND FIGURES

Table 1: Components of expanded chloride process plant and new finishing plant

Section	Components
Ore and coke handling	Add two new storage silos Add five new conveying systems Modify ore elevator to feed new silos
Chlorination	Add two new chlorinators Add one new cold cyclone Add one new sluice system
Condensation/purification	Add one new primary condenser Add one new secondary water cooled condenser Add one new brine cooled condenser Add two new brine refrigeration systems Add new purification system
Oxidation	Add new $TiCl_4$ and oxygen heaters Add new aluminium chloride generator Add one new reactor Add new bag filter Add four new slurry storage tanks Add ten new media mills
Finishing	Build two identical lines consisting of:- • one treatment tank; • three wash filters; • one drier; and • two fluid energy mills Add four pigment recovery thickeners Add chemicals make-up and storage facilities Add four bag packaging machines Add one semi-bulk packaging machine
Waste treatment	Add new process stack and scrubber Extend piping from existing maintenance scrubber Add thermal converter and waste heat boiler Extend suction vent system Add one new neutralisation system Upgrade pipeline to ocean
Utilities	Upgrade primary electrical substation Replace water treatment system Replace boiler Add new five-cell cooling tower Upgrade utility distribution system
Buildings	Expand workshops Expand laboratories Add new offices Add lunch room, change rooms and toilets Upgrade technical and engineering offices Add finished product warehouse Add materials stores Upgrade computer system

*Table 2 Estimated inputs and outputs from existing and expanded titanium dioxide plant**

Material	Unit	Existing	Expanded plant	Absolute Variance	% Variance
Production	tpa	79,000	195,000	116,000	147
Inputs					
Synthetic Rutile	tpa	84,000	206,000	122,000	145
Petroleum Coke	tpa	18,000	42,000	24,000	133
Chlorine	tpa	16,000	35,000	19,000	119
Oxygen	tpa	39,000	96,000	57,000	146
Nitrogen	tpa	59,000	145,000	86,000	146
Water	tpa	1,500,000	5,000,000	3,500,000	233
Natural Gas	Gjpa	370,000	980,000	610,000	165
Electricity	Mwh	29,000	97,000	68,000	234
Outputs					
Wastewater	m^3	950,000	3,000,000	2,050,000	216
Residue Slurry	tpa	141,000	397,000	256,000	182
CO	tpa	6,700	3,600	(-)3,100	(-)46
CO_2	tpa	70,000	194,000	124,000	177
$TiCl_4$	tpa	<0.5	<0.5	nil	nil
Cl_2	tpa	<0.5	<0.5	nil	nil
HCl	tpa	<0.5	<0.5	nil	nil
COS	tpa	540	540	nil	nil
SO_2	tpa	200	240	40	20
H_2S	tpa	<0.5	<0.5	nil	nil
NO_x	tpa	25	60	35	140
N_2	tpa	59,000	145,000	86,000	146

* Assumes thermal converter on-line 75% of the time

Abbreviations:

tpa = tonne per annum

Gjpa = giga joules per annum

Mwh = mega watt per hour

m^3 = cubic metre

< = less than

Schedule 2

Proponent's Consolidated Environmental Management Commitments

EXPANSION OF EXISTING TITANIUM DIOXIDE PIGMENT FACILITY TO 195,000TPA, KEMERTON INDUSTRIAL PARK (1006)

MILLENNIUM INORGANIC CHEMICALS LTD

EXPANSION OF EXISTING TITANIUM DIOXIDE PIGMENT FACILITY TO 195,000TPA, KEMERTON INDUSTRIAL PARK (1006)

MANAGEMENT PLANS

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
1. Amend and implement changes to environmental management plan and Manuals to reflect any changes to the operation.	To ensure that "Best Practice" environmental systems are in place that will result in minimal impact upon the receiving environment.	Amend, develop and implement changes as deemed necessary by changes to the operation and impacts. Train personnel in the procedures.	Prior to commissioning the expanded plant and where deemed necessary due to operational changes.	Department of Environmental Protection.	Audit systems to satisfaction of the DEP.
2. Continue to implement the Company's environmental systems manuals and audit their effectiveness.	To ensure that systems manuals are effective for the operation and that personnel have a competent understanding and adhere to the procedures.	Conduct audits and performance review of systems manuals and conduct training on the requirements of the procedures.	Annual audits and performance review. Environmental awareness training courses as deemed necessary.	Department of Environmental Protection	Manual audit of systems.
3. Amend and facilitate training programs for safety, environmental awareness and operational procedures to reflect changes to the operations.	To ensure that personnel are familiar with all facets of safety, environmental and operational procedures for the expanded operation to minimise occurrences.	Regular training sessions will be held as required to induct new staff and for retaining.	As deemed necessary.	Department of Environmental Protection	Internal audit Progress and compliance audit
4. Continue current monitoring programs and modify or expand where appropriate.	To ensure that the operations are not impacting on the receiving environment (air, land, water).	Design and submit programs to DEP for approval and conduct monitoring as specified on licence conditions or additional monitoring and deemed necessary by the Company or Department of Environmental Protection.	Prior to commissioning the expanded plant.	Department of Environmental Protection, Radiological Council of WA, Waters and Rivers Commission	Monitoring reports Audits

ATMOSPHERIC EMISSIONS

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
5. Install an integrated thermal converter system to reduce the volume of COS,H_2S and CO emissions and recycle waste heat.	Ensure that atmospheric emissions comply with current standards and do not adversely effect the environment, or the health, welfare or amenity of nearby land users.	Install a thermal converter to oxidise CO, COS and H_2S to CO_2, and SO_2. Utilise hot waste gases from the thermal converter to produce steam.	Initial design and construction phase. Prior to commissioning.	Department of Environmental Protection	Precommissioning report to the Department of Environmental Protection
6. Install a scrubber system capable of removing about 95% of SO_2 emissions	To reduce emissions of SO_2 to the atmosphere when the thermal converter is operating.	Install a scrubber system to remove 95% of resultant SO_2	Initial design and construction phase. Prior to commissioning.	Department of Environmental Protection	Monitoring and reporting to Department of Environmental Protection
7. Design the new process stack and emergency stack to ensure that gaseous emissions from the plant, including odorous gases, do not unreasonably interfere with the health, welfare, convenience or amenity of nearby residences (outside the Kemerton Industrial Park (KIP) boundary) even with the thermal converter on by-pass.	To ensure design of the stack is such that emission levels (both gaseous and odorous) comply with current standards and do not interfere with or adversely effect the environment, health, welfare or amenity of nearby land users.	Use appropriate computer modelling techniques at the works approval stage to confirm that ground level concentrations of licenced emissions meet DEP requirements and that the stack design is sufficient to meet the criteria.	Design stage confirm at works approval stage.	Department of Environmental Protection	Submission to Department of Environmental Protection at Works Approval stage. Monitoring and reporting to Department of Environmental Protection.
8. Ensure dust generation within the construction site does not exceed environmental limits and minimise dust emissions from the site during operations so that the health, welfare or amenities of nearby land users are not adversely effected.	To minimise dust generation to within acceptable community and regulatory standards.	Suppress dust generation during site preparation by the use of water sprays/trucks as required. Rehabilitate all areas that may generate wind blown dust. Install filters on finishing plant stack(s). Regularly monitor bag filter integrity.	During construction. Post-commissioning Throughout the life of the plant	Department of Environmental Protection.	Monitoring and reporting. Progress and compliance audits. Monitoring and reporting.

GREENHOUSE GASES

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
9. To enter into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement program on a project-specific basis.	To voluntarily reduce greenhouse gas emissions and cooperate with Greenhouse Challenge office	• Letter of Intent to join Greenhouse Challenge • Greenhouse agreement	• Signed by CEO and forwarded September 1998 • By June 1999	Department of Environmental Protection	• Initial report • Progress and compliance audit
10. Using methodology acceptable to the Greenhouse Challenge office estimate the gross emissions of greenhouse gases that may be emitted from the proposed project for each year of its operation in absolute and in CO_2 equivalent figures.	To quantify greenhouse gas emissions in absolute and CO_2 equivalent figures.	• Develop method • Reach agreement on method with Greenhouse Challenge office • Use method to assess greenhouse gas emissions	Within six months of completing commissioning phase	Department of Environmental Protection	• Report to Greenhouse Challenge office • Initial report to DEP • Progress and compliance audits
11. Using methodology acceptable to the Greenhouse Challenge office estimate: (1) The gross removals of greenhouse gases from either sink enhancement programs or Co_2 stabilising techniques, and (2) Loss of sink through land clearing.	To quantify gross removals of greenhouse gases from either sink enhancement programs or CO_2 stabilising techniques and loss of sink through land clearing.	• Develop method • Reach agreement on method with Greenhouse Challenge office • Use method to assess greenhouse removals or loss as per (1) and (2)	Within six months of completing commissioning phase	Department of Environmental Protection	• Initial report • Progress and compliance audits
12. To indicate the intended measures and efficient technologies to be adopted to minimise total greenhouse gas emissions in the proposed project including appropriate abatement measures where it does not conflict with commercial confidentiality.	To reduce greenhouse gases through the use of efficient technology where it is shown to be economically feasible and within the constraints of the design criteria and indicate these measures to the DEP and Greenhouse Challenge office.	• Use, where feasible, efficient technologies in design • Indicate the measures to the DEP	• During design stage • Throughout the life of the project • Within six months of completing commissioning phase	Department of Environmental Protection	• Initial report • Progress and compliance

NOISE

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
13. The proposed final plant design will comply with the assigned noise levels stipulated in the noise regulations.	Ensure that noise levels due to the company's operations meet acceptable criteria at residential areas, adjacent industries and boundaries.	Noise modelling. Consider noise emissions from machinery in plant design. Undertake regular ambient and source noise monitoring.	Completed for approvals process during plant design and construction. Throughout the life of the project. Both in-house and consultants.	Department of Environmental Protection (Noise Branch)	Department of Environmental Protection approval for expansion. Monitoring reports as required.

MARINE DISCHARGE

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
14. Continue to operate and monitor the neutralisation plant and discharge wastewater to the ocean.	Maintain saline water quality to a standard consistent with current DEP licence conditions.	Treat all wastewater prior to discharge and monitor prior to discharge for current DEP licence conditions.	Throughout the life of the project.	Department of Environmental Protection	Monitoring reports to Department of Environmental Protection (monthly).
15. Develop the ocean outfall diffusion system to maintain or improve dispersion of wastewater into the marine environment.	Maintain ocean water quality within the levels specified in the draft WA Water Quality Guidelines for Fresh and Marine waters (EPA Bulletin 711)	Develop outfall diffusion system using computer modelling techniques. Test outcome following commissioning by monitoring.	During design stage. Construction prior to commissioning.	Department of Environmental Protection	Department of Environmental Protection Works Approval Stage Receiving environment reports.
16. Continue to monitor the receiving environment	To minimise impact of saline water disposal on the marine environment.	Design monitoring program to encompass the additional discharge from the expanded plant and seek approval from the DEP to implement. Conduct a "current status" study of the receiving environment.	Prior to commissioning. On-going.	Department of Environmental Protection	Monitoring reports to Department of Environmental Protection "Current status" report to Department of Environmental Protection.
17. Alter the wastewater disposal system if problems are detected.	To continue to minimise impact of saline water disposal on the marine environment.	Redesign system if deemed necessary.	If problems should occur.	Department of Environmental Protection.	Monitoring reports to the satisfaction of the Department of Environmental Protection.
18. Submit a detailed wastewater disposal system proposal for the expansion to the DEP/EPA for assessment, if the waste water disposal system is not provided by the Water Corp,	To minimise environmental impacts through coordinated management and control of ocean dicharges	Prepare and submit a detailed wastewater disposal system proposal	Prior to commissioning of the expanded plant	Department of Environmental Protection.	Department of Environmental Protection. Environmental Protection Authority

SOLID RESIDUE

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
19. Continue to investigate and operate waste minimisation programs and undertake research into beneficial uses and options for solid residue.	To reduce the amount of solid residue produced per tonne of product and find alternative uses for the solid residue.	Pursue the residue minimisation program. Pursue use of solid residue for road construction, tip capping and soil amendment and pursue other alternatives and markets.	Throughout the life of the project.	Department of Environmental Protection.	Annual Dalyellup Audit Report to Department of Environmental Protection.
20. Continue to liaise with the Government Task Force to establish alternative residue disposal options and sites.	To co-operate with Government departments and consultants in locating future disposal options or site(s).	Ongoing discussion with Department of Resource and Development. Alternative sites investigations being carried out through DRD and consultants.	On-going	Department of Environmental Protection Department of Resource Development.	Annual Dalyellup Audit Report to Department of Environmental Protection.
21. Continue to monitor and undertake audits of the solid residue storage area at Dalyellup.	To dispose of solid residue by utilising methods that minimise environmental impact and have in place measurable systems to confirm.	Continue radiation and groundwater monitoring in accordance with Environmental Management Plan and systems manuals and Radiation Management Plan and submit an annual audit report and groundwater monitoring report.	Throughout the life of the Dalyellup site.	Department of Environmental Protection.	Annual audit report to Department of Environmental protection, Capel Shire. Annual Groundwater Monitoring Report to Department of Environmental Protection, Capel Shire and Landcorp.

RADIATION

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
22. Continue to implement the Company's Radiation Management Plan (RMP) and audit its effectiveness.	To ensure all radiological impacts are in accordance with the ALARA Principle and comply with currently accepted standards and codes of practice.	Maintain an up-to-date Radiation Management Plan and ensure personnel are aware of its content and responsibilities. Revise the RMP to include changes from the expansion. Advise all personnel of changes and provide specific training where required. Audit the RMP annually.	Throughout the life of the project. Prior to commissioning. On-going Annually	Radiological Council of WA	Annual audit by Radiological Health Branch of Health Department of WA. Reports to Radiological Council of WA. Dalyellup report biennial to Radiological Council of WA Recommendations to be produced in annual report to DEP

GROUND WATER

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
23. Continue to control surface run-off from the plant site.	To prevent ground water contamination from process areas.	Direct stormwater to infiltration ponds seal and bund process area. Direct all process area drainage to wastewater treatment plant. Monitor groundwater.	Initial design and construction phase. Throughout the life of the project.	Department of Environmental Protection Waters and Rivers Commission	Monitoring reports to Waters and Rivers Commission. Annual reports to DEP to verify submission of report to Water and Rivers Commission

WATER RESOURCES

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
24. Continue to explore opportunities to further recycle and reuse process water within the expanded plant.	Reduce overall water usage on a tonne per tonne of product produced.	Continue recycling of process water and investigate potential for reuse and recycling within the expanded plant.	Throughout the life of the project.	Department of Environmental Protection Waters and Rivers Commission	Monitoring reports to Waters and Rivers Commission
25. Submit a detailed groundwater supply proposal for the expansion, to the DEP/EPA for assessment, if the water supply for the expansion is not provided by Water Corp.	Optimise water resources and minimise environmental impacts.	Prepare and submit a detailed groundwater supply proposal.	Prior to commissioning of the expanded plant	Department of Environmental Protection Waters and Rivers Commission Water Corporation	Department of Environmental Protection Environmental Protection Authority

RISKS AND HAZARDS

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
26. Undertake technical and hazard reviews at all significant process changes and continue to implement the Centralised Control Policy regarding changes to plant detail.	To ensure that any process change does not impact adversely on the environment, workforce or nearby land users.	Review any significant changes to process through review committee and change order process.	Throughout the life of the project.	Department of Minerals and Energy DEP	Report to DEP with Department of Minerals and Energy's advice
27. Amend and implement the company's Total Hazard Control Plan (THCP) – now called Safety Report) to reflect any changes to the operation and audit its effectiveness.	To ensure off-site risk is as low as reasonably achievable.	Prepare and maintain THCP (now called the Safety Report) Maintain high plant safety rating through plant design and maintenance planning. Undertake regular internal and external audits to ensure THCP (now called the Safety Report) remains effective. Undertake a full Quantitative Risk Assessment (QRA) as part of the Safety Report	Prior to commissioning Throughout the life of the plant As required by Department of Minerals and Energy Completion of detailed project design	Department of Minerals and Energy Department of Minerals and Energy. Department of Environmental Protection	Internal audits External audits approved by Department of Minerals and Energy. Recommendations of external audits to be included in annual reports to DEP Meet the EPA's criteria for individual fatality risk off-site
28. Continue to conduct regular safety audits	To ensure that the company has in place systems and procedures that are auditable and effective in maintaining safeguards to both people and property.	Monitor the effectiveness of the system to safeguard people and property and to ensure that the systems are being adhered to.	Throughout the life of the project.	Department of Minerals and Energy Department of Environmental Protection.	Records maintained of audits. Progress and compliance report.
29. Ensure safe plant layout and operate the plant in a safe manner.	To design and operate the expanded plant in a manner that will be safe and not cause detrimental effects to the workforce, other industries or nearby land users.	•Design the plant to incorporate features described in EPA Bulletin 283 for layout, maintenance, general conditions and emergency plans. • Implement risk mitigation measures as identified in risk assessments, HAZOP reviews and safety audits.	Initial design and throughout the life of the project.	Department of Minerals and Energy Department of Environmental Protection.	Progress and compliance report. Department of Environmental Protection audit Department of Minerals and Energy/THCP (now called the Safety Report) Audit Internal audits

30. Amend procedures manual (Standard Operating Instructions, Process Control, Maintenance and Safety Procedures) to reflect any changes to the operations.	To ensure safe operation of the process plant and minimise incidents.	Amend, develop and implement procedures manuals to reflect changes to operation and train personnel in these procedures.	Prior to commissioning the expanded plant and where deemed necessary due to operational changes during the life of the operations.	Department of Minerals and Energy Department of Environmental Protection.	Audit systems to satisfaction of DEP, Department of Minerals and Energy
31. Minimise risk to persons involved in the construction of the expansion, from the operation of the existing plant	To protect health and safety of construction people	Prepare and implement a Construction Safety Plan	Before construction	Department of Minerals and Energy Department of Environmental Protection.	Approval of the plan by Department of Minerals and Energy. Auditing and reporting as required by the plan Precommissioning report to DEP
32. Continue to carry out preventative maintenance which includes replacement of sensors in oxidation system, testing of sensors in tail gas line, maintenance and testing of all sensors.	To ensure proper operation of all equipment and reduce the likelihood of incidents.	Programmed maintenance schedules using Maintracker maintenance system.	As per maintenance schedules.	Department of Environmental Protection	Audit by Department of Environmental Protection Audit by Department of Minerals and Energy Report on maintenance in annual reports to DEP

REHABILITATION

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	COMPLIANCE CRITERIA
33. To carry out rehabilitation and landscaping of the expanded plant to create an aesthetically pleasing operation that is complimentary to and maintains the integrity of the surrounding environs and meets the requirement of the Kemerton Industrial Park.	To operate an industrial process within a parkland concept that is aesthetically pleasing and maintains the integrity of the natural surroundings.	Prepare a Rehabilitation Management Plan. Implement the plan. Monitor progress of rehabilitation using criteria described in current systems manual.	Following commissioning of the expanded plant. Annual assessment.	Conservation and Land Management Capel Shire	Appoval by Conservation and Land Management or Capel Shire Progress and compliance reports.